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DAIRY-HERD TESTING FOR YIELD.

FACTORS INFLUENCING PRODUCTION.

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DAIRY-FARMING to-day is increasingly a scientific business, and as such requires the employment of careful and accurate methods. The present is a period for close application. When land, labour, and farming requisites were cheap, dairy-farming could be carried on without loss with far less skill than is the case to-day. Every factor is now of importance, and only those dairy-farmers who pay attention to detail and adopt scientific and businesslike practice can hope to succeed. The dairy industry has contributed very largely to New Zealand's fine standing as an agricultural country, and there is no larger scope for improving the industry than through the herd of the average dairy-factory supplier.

HERD-DEVELOPMENT.

Our dairy-farmers are continually confronted with the problem of herd-building. The dairyman acquires a farm and a herd, and plans by his labours to improve both and to work them to the maximum of efficiency. The personnel of the herd is ever changing, and even if a high average production is reached this has to be maintained. In building up the herd every step is important—culling, buying, breeding. Added to these is the general management of the herd. Success under each of these headings calls for experience and skill, and in each and every case the milk-scales and the butterfat tester form the crux of the

problem, the key to the situation. Whether the farmer buys or culls or breeds, the amount of butterfat which each cow produces is the indicator of the way. Yet, despite this, there are still many dairymen who are content to leave their herds untested and to work in the dark. Last year's statistics showed that New Zealand had 1,312,589 cows in milk and dry. For the same season about 151,000 cows were tested twice or more—this representing only 12 per cent. of the whole. Every dairy factory should have its herd-testing association, and every cow in every herd should be tested for at least a season.

WHAT INCREASED PRODUCTION MEANS.

There is no need to stress the fact that the testing of the dairy herd for butterfat-yield is the only way to arrive at that information which enables the owner to distinguish the cows which he is supporting from those cows which are supporting him. At the same time there are still many who do not fully recognize what the difference between a low-yielding and a higher-yielding cow may mean. It can be put very simply and clearly in this way: One cow may be worth—as a butterfat-producer—twice as much as another, or even more than two cows, although there may not be a very marked difference between the annual production of the two cows. For instance, let it be assumed that 160 lb. butterfat just pays for the year's care and feed, &c., of a cow. Then, a cow which produces 162 lb. butterfat is worth twice as much as a cow yielding 161 lb., because, obviously, she returns twice as much profit over care and feed. Similarly, a 260-lb.-butterfat cow makes twice as much above expenses as one which produces 210 lb.; or, she is equal to two cows each producing 210 lb.—that is, on the similar basis of 160 lb. butterfat returning exactly the cost of keeping and milking the cow. This means that a herd of, say, twenty cows with an average production of 260 lb. butterfat is as profitable as forty cows showing an average return of 210 lb.

Carrying the argument still further, one may compare two farms of equal carrying-capacity and carrying an equal number of dairy cows, and assume that number to be forty. If the forty cows on one farm yield 210 lb. butterfat each, and those on the other farm 50 lb. more, or 260 lb., then the higher-producing herd yields 4,000 lb. more butterfat in actual profit for a practically similar outlay in feed and care. With butterfat at 1s. 6d. per pound this means £300 per annum in money. Further, one cow producing only 100 lb. butterfat may nullify the profits on six cows each producing 170 lb. Summed up, it means that many dairy-farmers are keeping two or even three inferior cows where one better one would yield them as much profit, at one-half or one-third of the expenditure and labour. Dairy-farmers will therefore see that every pound of fat added to the average production means a considerable increase in their profits.

BASIS FOR CULLING.

The predominant principle in herd-testing is that the herd-owner may be supplied with more accurate data on which to form his judgment respecting the individual members of his herd from the viewpoint of production. The minimum production on which the

owner will determine his culling will necessarily depend on various factors, some of which may be stated as follows: (1.) Replacement: If he is keeping his herd up by purchasing he may adopt a more arbitrary standard, whereas if he is breeding heifers for replacement he has to consider the number of them available. (2.) The amount of feed available, which will largely depend on the character of his soil and quality of his pastures. (3.) On land higher in value than the average a higher production per cow is a general necessity.

IMPORTANCE OF THE HERD SIRE.

There are two safe methods of building a dairy herd: one is to buy in cows of suitable type and authenticated yield; the other is to begin with cows or heifers and a proven sire, or one backed by butterfat records, and to build gradually by culling out the low producers and breeding from the higher-yielding cows of suitable type. To continually buy in new stock requires more finance than many of our dairy-farmers can afford. Then again, few dairymen will sell their best cows unless they are past their prime, so that the purchaser is continually confronted with difficulties, and may sometimes find he is accumulating a herd of culls. The butterfat-record-sire method is perhaps a slower one, but is to be recommended. And, further, for quickest and most satisfactory results the sire should be a purebred.

The certificate-of-record system of testing purebred dairy cows provides for a 365-day milking-period. C.O.R. testing has now been conducted in New Zealand for some thirteen years, and it is advocated that for grade and crossbred herds the sire be selected from C.O.R. dams. If it is proved that for several generations certain females can give outstanding yields, then it is a reasonable assumption that by mating a bull from such dams with ordinary herd cows the resultant offspring should be an improvement on their dams. When selecting the sire the pedigree should be studied from the point of view of production of ancestors on both sides of the family, and productions of recent members should be given more importance than those of several generations back. The length of time that C.O.R. testing has now been in existence in New Zealand enables selectors to obtain full information in many cases for several generations of pedigree.

Next to production comes the question of type, and, although yield is of major importance, the selected sire should conform to accepted standards of true dairy type, and should possess the desirable characteristics of a herd sire.

There is a tendency among dairymen to use a sire for a season or two and then sell or destroy him. The true test of a sire is the quality of his daughters. If they are an improvement over their dams from the point of view of production, and do not retrogress in type, then it may be accepted that the sire is a success. Not until the daughters bear living testimony to the inefficiency of the sire should he be destroyed.

The advantage of a purebred over a crossbred sire is considerable. Experiment has proved that with a purebred bull a breeder is likely to achieve more in two generations than in five generations with a grade bull three-quarters pure.

INFLUENCE OF THE PUREBRED DAIRY SIRE.

As previously stated, the true test of a sire's worth is the quality of his daughters. It is difficult to get herd-testing-association figures on this phase of the subject, as our records do not include any information with respect to pedigree. From our records, however, have been collected sixteen instances where both daughter and dam have association records, the daughters having been sired by a purebred butterfat-record bull. Their sixteen daughters have improved on the average production of their dams by no less than 124·24 lb. butterfat. With two exceptions, each daughter has exceeded the production of her dam. These two daughters were two-year-olds; one produced only 3 lb. of butterfat less than her dam, and the other 21 lb. less. Doubtless, at ages equal to that of the dam these two daughters would show a higher yield. The sixteen dams were sired by eleven different bulls, so that the examples are fair, and the improvement cannot be attributed to the influence of one or two outstanding dams. Moreover, only two sires are represented, so that it may safely be assumed that the improvement has come from the male side.

Another example is the case of five different dams each from a different sire, and mated with a butterfat-record bull. These five dams, at an average age of 8 years 87 days at commencement of test, yielded an average of 441·36 lb. butterfat. Their five daughters, each from the butterfat-record bull, yielded, at an average of 1 year 347 days, 624·77 lb. butterfat, an average increase of 183·41 lb. The fact that the average production of the five dams was already very creditable, and that the average age of the daughters was low, makes this example an outstanding one. These figures are quoted from our C.O.R. returns to show what is possible if the right sire is chosen. What is more, the success of this particular sire was a more or less natural expectation, owing to the information which his butterfat-record backing supplied. He was line-bred to an outstanding bull of the breed, and, apart from this, the other animals figuring in the pedigree were for several generations back of proved outstanding merit.

LENGTH OF MILKING-PERIOD.

Statistics show that the average cow on association test in New Zealand milks about 230 days. It is safe to assume that the average lactation for all cows in the country is less. The writer has frequently expressed the opinion that the season of the average dairy cow in New Zealand is too short. Even on the basis of 230 days it means that there are more than four months in which our average dairy cow is doing nothing in butterfat-production. During that period she requires bodily maintenance, and general charges bearing on the cost of the cow's keep continue much as during the milking-period. Two months' rest from milk-production should be sufficient.

An endeavour should be made to obtain a type of dairy cow which will naturally milk a greater portion of the season than is the case at present. It may be possible by means of forced feeding and extreme care to extend the lactation of the average cow now in our dairy herds, but if the butterfat so added to the seasonal total does not compensate for the time and money expended, then the practice is

undesirable. The length of lactation should be governed by the efficiency of the cow as a butterfat-producer.

Progressive dairy-farmers recognize that a prolonged milking-period is the outcome of breeding and feeding for the longer lactation. Here again is driven home the importance of a herd sire chosen with regard to the results of the certificate-of-record testing, which provides for a 365-day production. If it is proved that for several generations certain females can maintain their production for a whole year, then it is a reasonable assumption that by mating a bull from such dams with ordinary herd cows the average term of profitable lactation will in time increase. Dairy-farmers should fully recognize that money spent in the purchase of a butterfat-record purebred sire is well invested.

DUAL VERSUS SPECIAL PURPOSE.

While no cow can do her best in producing milk and butterfat without an ample supply of succulent feed and without kindly treatment, the greatest consideration is the inherent tendency of the individual cow. In the earlier days of dairying in New Zealand the popular cow was what was called the dual-purpose cow, the two purposes being the production of both butterfat and beef from the same animal. In the minds of dairymen the dual-purpose cow was a sort of wonder animal which combined the best qualities of the two types. Experience, however, has proved that dual purpose is often another name for no purpose, and that by attempting to develop each, it happens more often than not that both beef and butterfat are sacrificed. There is perhaps no greater menace to our dairy industry than the dual- or no-purpose cow.

There are four types of cow—namely, (1) beef type, (2) dual purpose inclined toward beef, (3) dual purpose inclined toward dairy, and (4) special-purpose dairy type. Professor Haecker, at the University of Minnesota, conducted experiments with reference to the cost of production by these various types. Strict account was kept of the yield, and of all food consumed by each individual cow. Although the figures are old and may not apply to-day in actual values, it is evident that in proportion they will be as true as ever. The figures representing the feed cost per pound of butterfat were reported as follows: Beef type, 8·75d.; dual purpose inclined to beef, 7·55d.; dual purpose inclined to dairy, 7·30d.; dairy type, 6·05d. In every instance a cow of special-purpose dairy type produced a pound of butterfat at a lower feed cost than did any animal in the other three classes.

It is apparent that some animals use their food for the production of milk, others devote the larger proportion to the production of beef, while others—the dual purpose—may produce neither beef nor milk at a profit. It requires a certain amount of food to maintain the body of a cow, and the surplus she eats beyond this goes to milk or beef, or both. The general conformation of the cow is often an indication of what may be expected from her in the way of production.

There is an old argument that when a dual-purpose cow is done with she is worth a fair price to the butcher, whereas the finer-cut true dairy type will fetch very little. Fig. 1 shows a cow which on association test gave 3,268 lb. milk and 136·18 lb. butterfat. Fig 2.

shows another cow which also on association test produced 8,658 lb. milk and 404·77 lb. fat. The difference between these two yields is 268·59 lb., which, with butterfat at 1s. 6d. per pound, works out at a little over £20. And this was for one season only.

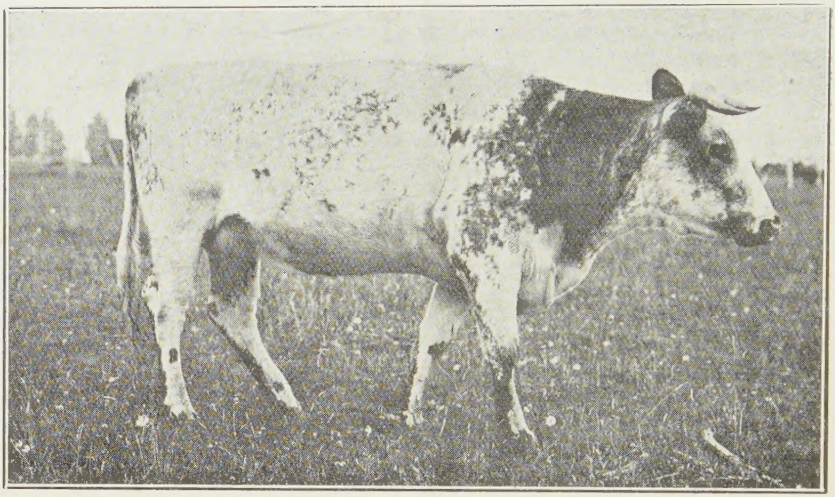

FIG. 1. UNDESIRABLE TYPE OF COW FOR DAIRYING.
Season's yield only 3,268 lb. milk, containing 136 lb. butterfat.

FIG. 2. SPECIAL-PURPOSE DAIRY TYPE.
This crossbred cow milked 293 days, and gave 8,658 lb. milk, containing 404 lb. butterfat. Both animals shown were from ordinary mixed herds on association test. They were dry when photographed.

COMPARISON OF ASSOCIATION, C.O.R., AND FACTORY RETURNS.

The association system of testing, as is well known, supplies an index to the season production of a cow. Milk weights and samples are taken for two consecutive days in each thirty days, and the production for each thirty-day period is calculated on the basis of proportion. It is essential that the monthly weighing and sampling should be conducted at equal periods throughout the whole season, otherwise the butterfat-production according to the association records may not be as reliable as desirable. Careful weighing and sampling are also essential. Some dairy-farmers disparage the association testing because it does not agree with the factory returns. Before a fair comparison of the two is possible the returns should be for exactly the same period, and the total milk be from the same number of cows in each case. If proper and fair comparisons are made it will usually be found that the two will agree within satisfactory limits. Breeders of purebred dairy stock with the same cows under both C.O.R. and association test have a good opportunity of confirming the accuracy of the association system, and their opportunity of so doing is less fraught with difficulty. It has been found that, provided the weighing and sampling for the association returns are carefully and conscientiously carried out, results from the two methods will usually compare favourably. It may be accepted without discussion that the C.O.R. system gives results as accurately as may be expected, and is therefore a suitable basis for comparison.

In comparison of association and factory returns two examples may be selected from a number which have come under our notice. A herd of eighty-five cows in one association was credited with 12,909·5 lb. butterfat; the factory returns showed 12,760·7 lb. for a corresponding period. A herd of forty-two cows over a period of four months showed a variation of only 46·72 lb. butterfat between returns of association and factory, the association return being 5,468·66 lb. and that of the factory 5,421·94 lb.

There are, as previously suggested, certain factors which make it unreasonable to expect association and factory returns to exactly agree. These may be stated as follows: (1.) Milk fed to calves and milk for household purposes. (2.) Loss of butterfat in separation. (3.) Loss of butterfat in transit of cream. (4.) Inaccurate sampling. (5.) General conditions, such as weather, feeding, &c.; the association weights and samples may happen to be taken when the cows are producing normally, or when they are below normal, or when they are above normal; if the samples and weights are taken at an abnormal period the returns for the whole thirty days are affected. Speaking generally, although a comparison of returns, period by period, may not always give the agreement which might be desired, it is usually found that over the whole season the factory and association returns—taking into consideration these influencing factors—will compare satisfactorily.

In the following table are given the results for eighty-four cows which were tested under both association and C.O.R. system during the same lactation. In those cases where the cow was not on association test for the same period as she was under C.O.R. test the records

have been adjusted to the same number of days in milk, so as to make the comparison a fair one.

Number of Cows.	Total Differences. lb.	Percentage Variation.
30	459·21	4·2
35	456·37	3·7
19	194·32	2·4
All 84	1,109·90	..
Average	±13·21	3·6

Eighty-four cows will be accepted as representative, and, as will be seen, the average variation from the C.O.R. is only 3·6 per cent. This must be considered adequate proof of the accuracy of the association system.

EXAMPLES OF HERD-IMPROVEMENT.

The mass of herd-testing-association returns received by the Dairy Division from year to year supplies a large number of examples of improvement in average herd yield. The four cases quoted in the following table are more or less typical.

Member.	First Season.			Second Season.			Third Season.			Season Increases of Butterfat.		
	Number of Cows.	Average Days.	Average Fat.	Number of Cows.	Average Days.	Average Fat.	Number of Cows.	Average Days.	Average Fat.	Second over First.	Third over Second.	Third over First.
			lb.			lb.			lb.	lb.	lb.	lb.
A	44	270	256·72	40	280	314·84	41	281	334·25	58·12	19·41	77·53
B	39	206	213·51	42	278	303·99	41	272	319·30	90·48	15·31	105·79
C	47	226	271·30	47	230	314·30	50	276	335·58	43·00	21·28	64·28
D	47	197	198·00	46	220	248·37	44	230	287·96	50·37	39·59	89·96

As will be seen, the most marked improvements are for herds B and D. It will be noticed, however, that, to begin with, the average production in each of these cases was considerably below that of A and C. Obviously in herds A and C there was less room for improvement. When the average herd yield gets around the 300 lb. mark, improvement is slower and more difficult to maintain.

IMPROVEMENT IN ASSOCIATION AVERAGES.

Following are examples of improvement in production of average cow for associations as a whole. The figures cover the first four years' work of two associations.

Association A.

	Cows.	Days.	Butterfat. lb.
First year	430	236	219·93
Second year..	297	233	231·13
Third year	618	258	261·45
Fourth year..	620	264	286·60

Association B.

First year	265	187	177·58
Second year..	298	200	190·74
Third year	406	212	215·70
Fourth year..	266	214	232·37

Apart from the marked increase in average yield in each case will be noted the increase in length of average milking-period. High yield and long lactation, provided the cow herself is right, usually go hand-in-hand.

By way of deduction it may be pointed out that in Association A the increase is about 66·67 lb. butterfat. Had the 430 cows on test in the first year averaged the same as the 620 on test in the fourth year, it would have meant an increased total yield of 28,668 lb. butterfat, which, at 1s. 6d. per pound, means £2,150. On a similar basis the Association B results work out at about £1,085.

THE BUTTERFAT TEST.

Supplying a dairy factory often tends to emphasize in the minds of suppliers the *percentage* of butterfat in the milk supplied — commonly called the "test"—rather than the *quantity* of butterfat. Although the education which herd-testing has helped to develop has done much toward dispelling this tendency to think in terms of "test," one still finds many dairymen who are apt to overstress the importance of the butterfat percentage. Unless the herd is used for supplying milk for human consumption, when a certain legal minimum of fat has to be adhered to, the "test" itself can be taken too seriously. And, after all, even dairy factories do not pay out on test, but on test multiplied by weight of milk supplied — a very different matter. There is also a tendency, though less frequent, to stress milk-quantity; this is not as common in New Zealand as in those countries where records are taken for yield of milk alone.

A good example of the inaccuracy of judging milk-production by test alone or quantity of milk alone is found in a study of the records of purebred cows under C.O.R. test in New Zealand. Taking all Friesians (413) in the two-year-old class which have gained certificates since the commencement of the C.O.R. system in 1912 to the end of 1923, it is found that the six highest-testing individuals averaged 4·74 per cent., and the six lowest only 2·79 per cent. Judging from the test alone the first mentioned were 69 per cent. better cows than the lower testers. On milk alone the higher testers yielded on the average 9,601·4 lb., and the lower group 16,012 lb.; so that, judged on milk alone, the one group was approximately 67 per cent. better than the other. When one comes to butterfat, however, it is found that the average production for the groups was 455·19 lb. for the six higher testers and 447·26 lb. for the lower—an actual difference in production of only 7·93 lb., or, on a percentage basis, 1·8. Surely this speaks for itself.

All things considered, therefore, it is not right to judge a cow by milk alone or by test alone. The only fair and accurate guide to the ability of the dairy cow is her season butterfat-yield.

TEST VARIATION.

Another phase of the test problem which plays a prominent part in the minds of persons interested is that of the variation in the percentage of butterfat in milk. This matter has been fully dealt with by special articles in the *Journal*, but a few general remarks may not be inappropriate here. The examples quoted are gleaned

from data of C.O.R. testing, under which system the milk-samples are both taken and tested by the Dairy Division's fully qualified testing officers. The information is perhaps all the more valuable because purebred cows are, as a class, better cared for than the individuals of an average dairy herd.

We have known several instances of each of the following: (1.) Cows giving equal milk-weights for two consecutive days (with general conditions normal) and the same to show variations in test of 12 to 18 points. (2.) Cows decreasing by 10·9 lb. of milk and 24 points in test from one day to the next; 5·4 lb. milk and 12 points in test; and 2·5 lb. milk and 15 points in test. (3.) Cows increasing 3·8 lb. milk from one day to the next and increasing 11 points in test; 4·1 lb. milk and 8 points in test; 2 lb. milk and 22 points in test. (4.) During the menstruation period some cows have varied little, if any, in either milk or test; some have evidenced a decrease in milk-yield while the test has remained unaffected; some have shown a normal milk-yield and a decrease in test; and in some cases both milk-yield and test have been affected. (5.) It has also been proved that a change of milker may affect both milk-yield and test, usually to disadvantage. It pays to have cows milked by the same milker at each milking.

It therefore follows, as a general summing-up, that there is no definite rule governing a cow's test. Experience shows, however, that normal conditions, kindly and even treatment, and scrupulous care are well repaid. It is also obvious that when unaccountable test-variations occur such should not be immediately attributed to carelessness, malice, or lack of ability on the part of the person carrying out the testing of the samples.

FEEDING AND TREATMENT.

The dairy cow is a machine which will not give best results unless it is fed with the right quantity of the right material. It is possible to overfeed a cow with concentrates, in the same way as it is possible to overfeed a machine. The general tendency, however, is very much on the side of insufficient feeding. This may be the result of overstocking or merely lack of attention to this phase of the subject. If a cow is of the right type it is usually found that the larger eater is the heavier producer. After maintaining her body, the more surplus feed she will convert into milk and butterfat the less is the proportionate cost of the butterfat.

It is better to permit twenty cows to yield 5,000 lb. of butterfat than to increase the herd to thirty cows and produce the same total, or more probably a reduced total, if the feed be only that quantity required by the twenty. Many of our dairymen are reducing their profits by endeavouring to run more cows than their land can profitably carry.

It is also a common practice to neglect dry cows, with the result that they freshen in poor condition. It pays to feed dry cows well. If they calve in poor condition they devote what should be their highest-yielding period to recovering the drain on the body occasioned by pregnancy and the act of calving and getting back into normal working condition. What is more, their whole season usually suffers, as often they do not pick up until their milk-flow is past its highest point for the season. On the other hand, if they come in a little

heavy in flesh the body is able to counteract the strain of freshening, and not only is the milk-yield and test improved, but the maximum milk-flow is maintained for a longer period and the length of the lactation increased.

Cows require even and kindly treatment. The ideal dairy-farmer does more than treat his cows sympathetically. Cruelty has been proved to affect both milk and test to the detriment of the factory return. Continued cruelty will shorten the lactation period—the owner is fined in pounds, shillings, and pence for every unkind act. The dairy cow is highly strung and sensitive, and these characteristics are more pronounced in the more refined and better-class animal. Speaking broadly, the cow gives what she receives. In return for proper feeding and kindly treatment she will give the best that is in her. Cruelty and lack of feed and care will kill those qualities which make her worth while as a dairy cow.

CONCLUSION.

Systematic herd-testing is a path which tends towards monetary success, but there is more in it than that. There is an educational value. The true dairy-farmer is a student and a breeder. The continual study of records and the increasing application and result of breeding-principle and experiment tend to broaden his intellect and make him methodical, painstaking, and quicker to recognize efficiency. It is gratifying to note from the steadily increasing number of herd-testing associations in this country that the great value of herd-testing, and all the term means, is making its importance realized.

The writer desires to cordially acknowledge the co-operation of Mr. H. G. Philpott, of the Dairy Division headquarters staff, in the preparation of the foregoing article.

Grading up of Sheep Flocks.—In the course of his recent report on the conditions and practice of sheep-farming in the Falkland Islands Mr. Hugh Munro, of the New Zealand Department of Agriculture, remarks: "When grading up from nondescript flocks it is a mistake to purchase high-priced rams to start with. In this country (Falkland Islands) I have seen rams which cost in England from £40 to £70 mated with very ordinary ewes of very mixed breeding, and I am informed that others costing up to £150 each have been imported and used in the same manner. Infinitely better value would be obtained by purchasing purebred flock rams at about £10 each (New Zealand price), for the reason that, when mated with this class of ewe, they will give equally good results and more can be imported for the money. There is no short-cut to the improvement of a nondescript flock. They must be graded up by each successive generation becoming better than the preceding one, by careful selection of the breeding-ewes, and the use of purebred rams of a higher standard of quality than the ewes."

Haystacking Precaution.—A farmer was killed recently in Taranaki during haymaking operations by the fall of the heavy centre pole of a stacker, through one of the guy-rope pegs pulling out of the ground. Evidence showed that the peg had been driven in about 1 ft. Although this followed the usual practice in the district, the occurrence indicates the necessity for great care in staying stacker poles, and that a greater depth than 1 ft. is requisite for pegs or stakes, according to conditions of soil, &c. The Coroner's jury recorded their opinion, in fact, that posts should be used instead of pegs.

LUCERNE VERSUS TEMPORARY PASTURE.

A COMPARISON AT MARTON.

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It is well recognized that where suitable conditions for lucerne exist there is no more valuable crop our farmers can grow, this having been proved many times. Unfortunately, however, it has been stated repeatedly that lucerne will grow on all types of soil and under practically any conditions; and while this may be literally true, the growing of lucerne on certain types of land has often turned out to be an unsound proposition, much to the farmer's regret. In considering lucerne, the point is not so much whether it will grow, but whether it will give returns in excess of any other crop in respect to quality, yield, and cost of production. The answer to the latter query is occasionally in the negative.

SOIL CONDITIONS AT MARTON.

The soil of the Marton Experimental Area, which is typical of much of the land in the district, is by no means a suitable one for lucerne. It is of a heavy clay type—so heavy and puggy, in fact, that mole drains (made by the drain-plough) have lasted for over fifteen years, and at the end of that period were still working satisfactorily in parts. The clay surface soil is underlaid in many situations by a stratum of hard ironstone which varies in depth from a few inches up to 18 in. or 2 ft., and lies anywhere between the surface and a depth of 4 ft. or 5 ft. This stratum could hardly be called a hardpan, however, as it is more or less broken, and is not continuous.

In connection with this ironstone it is interesting to note that during the summer months the roots of the lucerne go down beyond the stratum and draw their nourishment from below it; but with the rise of the dead-water level during the winter months the roots rot back to the ironstone, and it is not until the fall of the water in spring that the roots go down again. Thus it must be seen that much of the plant's strength is used up in the growing of new deep roots each spring, and this no doubt accounts to some extent for the slowness with which the crop comes away at that period. This is probably only a contributing factor, as the nature of the soil itself does not tend towards early growth.

Considering the soil-conditions at Marton it must be recognized that the lucerne has done remarkably well in yielding as it has, and its success is largely due to the fact that the stand has never been grazed. With constant or even occasional stocking the stand would probably have died out during the first season or two; it certainly could never have lasted as it has. It should be noted that, owing to the nature of the land, the crop has never been successfully cultivated. In early spring the land lies too wet for cultivating, the clay holding the moisture for a much longer period than a lighter soil would; then in autumn the land is too hard, and consequently cultivation cannot be carried out. This, of course, is only another point against the growing of lucerne on that type of soil.

LUCERNE AND TEMPORARY PASTURE: POINTS OF COMPARISON.

In making a comparison between a lucerne stand and a temporary pasture there are several points that must be kept in view. Firstly, there is the length of period of the usefulness of each of these crops. For instance, even on the class of land now referred to, the lucerne crop should continue to give fair returns for a considerable period after the temporary pasture has outlived its usefulness. Temporary pasture under many conditions, however, can be made to give splendid returns for five years or more by careful treatment, as will be shown. Secondly, it is important to bear in mind that hay crops from the lucerne stand represent the total usable product from that crop for the whole of the year, and especially so where grazing in the spring and late autumn cannot be carried out, or would be disastrous if attempted. On the other hand, the hay crops from the temporary pasture represent but part of the year's return. It may even be held that the hay crops are but four months' growth, while the remaining eight months represent a very considerable return through grazing. Thirdly, the cost of the year's operations in connection with each crop must be considered, and in this connection it will be seen that the annual cost per crop is about the same. Lucerne will require the same top-dressing, hence the manure bills will be equal. With regard to cost of harvesting, this should favour the temporary pasture, for with the latter there are at the most two hay crops a year to handle, whereas with lucerne there will be the cost of harvesting three or four crops.

RECORDS OF FIVE SEASONS.

The lucerne stand at the Marton Area was put down in December, 1918, when 15 lb. of Marlborough seed was sown to the acre. The land was limed with carbonate of lime at the rate of 1½ tons, and manured with basic super at the rate of 3 cwt. per acre. In the same year—November, 1918—a temporary pasture consisting of 25 lb. Italian rye-grass and 5 lb. cow-grass per acre was sown. It will be noticed that this is a purely temporary mixture. Basic super was applied with the seed at the rate of 2 cwt. per acre. It is between these two crops that a comparison will be made. In connection with the weights recorded hereafter for both crops, the figures given are tons and hundredweights of green material. Hay crops at the Area are carefully weighed when cut, so that these weights are accurate and representative.

During the 1919–20 season, unfortunately, no record was kept of the yield from the lucerne stand, but the temporary pasture was closed for hay on 1st October. It was cut on 19th December, and yielded 7 tons 14 cwt. per acre. The material was mostly rye-grass. On 16th February it was again cut, yielding 7 tons 15 cwt. of first-class cow-grass, giving a total return of 15 tons 9 cwt. per acre for the period 1st October to 16th February. This field (5 acres in all) carried 135 sheep all through September, and was ready for grazing again at the end of February. In addition to this the field carried between two and three sheep to the acre for the remainder of the year.

The following season, 1920-21, the lucerne was cut three times, yielding in all 17 tons to the acre. This same season the pasture field was closed for hay on 18th October, and was cut on 13th December, yielding 12 tons 17 cwt. per acre. The field remained closed until 17th March, when it was cut for a seed crop, this cut being practically pure clover. On threshing it yielded 148 lb. of clover-seed to the acre. During the month preceding the date of the first shutting-up for hay the 5 acres carried 101 sheep, and the area was again ready for grazing at the end of March. No actual record was kept of the grazing for the remainder of the year, but it is estimated that it carried between three and four sheep per acre.

The lucerne crop yielded four cuts during the 1921-22 season, the total yield on this occasion being 22 tons 6 cwt. per acre. The temporary-pasture field was closed early in October and cut for hay on 19th December. This crop yielded 14 tons 15 cwt. per acre. The pasture was cut for hay a second time on 13th February and yielded 6 tons 8 cwt., making a total yield for the year of 21 tons 3 cwt. In addition to this the area carried an average of 2·8 sheep for the whole year, or an average of 4·3 sheep for the period when it was not shut up for hay. It should be stated that in the early spring of this season the pasture was top-dressed with 10 cwt. of carbonate of lime and 2 cwt. of super per acre.

The 1922–23 season was not a favourable one for haymaking, and this put the lucerne at a greater disadvantage than the temporary pasture. Had the weather been favourable a fourth cut could have been made, but, as it was, only three were taken. The three cuts yielded a total of 17 tons 16 cwt. per acre. Only one cut of hay was taken from the temporary pasture during this season, on account of the weather conditions; it yielded 8 tons 3 cwt. per acre. In addition to this the pasture carried just over 2½ sheep per acre for the whole year.

Three crops were taken from the lucerne area during the 1923–24 season, the total yield being 14 tons 10 cwt. per acre. The temporary pasture was now in its fifth year, and yielded but one cut of grass, and that a fairly light one—5 tons 9 cwt. per acre. Notwithstanding the length of time that the pasture had been down, its carrying-capacity averaged 1·78 sheep per acre during this season, and it would have comfortably carried two sheep had they been available.

The results of the five seasons under review may be briefly summarized as follows, all yields given being green weights:—

Season.	Lucerne (sown December, 1918).	Temporary Pasture (sown November, 1918).
1919-20	No record	Two cuts, totalling 15 tons 9 cwt.; 135 sheep all September; 2½ sheep per acre for year.
1920–21.	Three cuts, totalling 17 tons ..	One cut—12 tons 17 cwt.; seed-yield, 148 lb. per acre; 101 sheep all September; 3½ sheep per acre for year.
1921–22	Four cuts—22 tons 6 cwt. ..	Two cuts—21 tons 3 cwt.; 2·8 sheep for whole year.
1922–23	Three cuts—17 tons 16 cwt. ..	One cut—8 tons 3 cwt.; 2½ sheep per acre for whole year.
1923–24	Three cuts—14 tons 10 cwt. ..	One cut—5 tons 9 cwt.; 1·78 sheep per acre for whole year.

FIG. 1. SHOWING A SECOND CROP OF LUCERNE AT MARTON EXPERIMENTAL AREA; CUT IN JANUARY.

FIG. 2. MAKING A FIRST CUT OF THE TEMPORARY PASTURE AT MARTON IN DECEMBER.

As will be noticed, this crop consisted mainly of rye-grass.

From the foregoing records it will be seen that, taking all things into consideration, the returns from the temporary pasture are in excess of those from the lucerne. The actual hay-yields from the pasture (although it must be remembered this hay is not quite so high in quality as the lucerne hay) are very little below those of the lucerne, and then in addition the grazing of the pasture, which is very

FIG. 3. A SECOND CROP OF THE TEMPORARY PASTURE; CUT IN JANUARY.

This was an even mixture of rye-grass and cow-grass.

FIG. 4. LAMBS ON AFTERMATH OF THE TEMPORARY PASTURE, FIVE WEEKS AFTER SECOND CUTTING.

The growth in this case was chiefly cow-grass

considerable, must be taken into consideration. The quality of the grazing is shown in the increase in weight that lambs have made on the aftermath of clover after the second cut of hay. During February of this year twenty-four cull lambs were weighed and turned on to the clover. At the end of a fortnight they were again weighed and found to have put on an average of $4\frac{1}{2}$ lb. per head.

A FURTHER COMPARISON.

In April, 1923, a further 13½ acres of temporary pasture were put down, the mixture being a little different from the previous one, having 10 lb. of perennial rye-grass included. This rye species, being more permanent, should give the pasture a longer life. During the past season this pasture was cut twice for hay, the first cut yielding 8 tons 18 cwt. of green material per acre, and the second cut yielding 7 tons 11 cwt., making a total of 17 tons 9 cwt. per acre for the season. The carrying-capacity of this area for the year ended June, 1924, was 2·78 sheep per acre. For the period between June and the shutting-up of the area for hay it carried just over three sheep. Although it is hardly fair to compare these results with that of the lucerne stand, which is now in its seventh year, it may be noted that the yield of the lucerne for the past season was 16 tons 15 cwt. of green material.

CONCLUSIONS.

The experience at Marton Experimental Area seems to indicate that temporary pasture of Italian rye-grass and cow-grass should there not be kept down longer than four years, as there is a considerable reduction in yield after that period; while in the case of the lucerne the yield in its sixth year was equal to the average of the previous five years. In any comparison between lucerne and temporary pasture at Marton the cost of renewal of the pasture has to be taken into consideration. As £4 per acre will be more than sufficient for renewal, allowing four years as the duration of the temporary pasture, it has to be weighted with £1 per year in excess of the lucerne. The high grazing-capacity of the temporary pasture would, however, in the case of soil similar to that of the Marton Area make any comparison distinctly in favour of temporary pasture.

WINTER DAIRYING AT HANMER SPRINGS.

The Queen Mary Hospital farm at Hanmer Springs, North Canterbury, is operated primarily for the purpose of supplying milk to the hospital, and the supply must thus be kept up all through the year. The farm is situated 1,200 ft. above sea-level, and the locality is subject to heavy falls of snow in winter. The land is very poor, and owing to the comparatively short growing season the dairy herd has to be hand-fed for six months of the year, during which period the pastures are practically negligible. For four months of the winter the cattle are housed and all food is supplied in the bails. The food consists of oat-sheaf chaff, bran, oil-cake, mangolds (in season), hay, and rock salt. The cattle are given the following daily rations: Chaff, 14 lb.; bran, 2 lb.; oil-cake nuts, 2 lb.; mangolds, 40 lb.; and as much hay as they will consume. All this fodder is of the best quality, and the ration varies according to the time each cow has been in profit. Thus a cow six or seven months in milk will not be getting so large a ration as a cow at full profit.

During the winter of 1924 the herd consisted of fifteen to seventeen head, and ranged from cows fresh in profit to others seven and eight months in milk. During the six feeding-months, from April to September inclusive, eight cows were turned out dry and replaced with fresh ones, so the winter ended as it began with cows ranging from fresh in to others six and seven months in profit. The milk produced during the six months was 8,943 gallons, which averages close on 3 gallons per cow per day. The experience here recorded is claimed as a demonstration that winter dairying can be profitably conducted if carried out on right lines even under unfavourable natural conditions. The particulars were supplied by the farm-manager, Mr. W. B. Willis.

STINKING-SMUT OF WHEAT.

II. FIELD EXPERIMENTS ON CONTROL.

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A PRELIMINARY article on stinking-smut of wheat appeared in the *Journal* for September, 1923. It contained a brief account of the available knowledge of the disease and the results of laboratory experiments with certain treatments in control. The present article records the results for 1924–25 of comparative trials in the field of sixteen of the most successful seed-treatments used in this and other countries for the control of this disease.

GENERAL PLAN OF EXPERIMENTS.

Four varieties of wheat were used in the experiments—Pearl, College Hunter's, Purple-straw Tuscan, and Solid-straw Tuscan. The last-named was harvested in January, 1924; the other three were one year older, being in fact the same parcels of wheat from which the samples used in the 1923 experiments, referred to above, were taken. All had been machine-threshed in the usual manner, and, for the purpose of these experiments, were inoculated in bulk with one part of smut-spores to 750 parts by weight of seed. The sample of smut consisted of *Tilletia Tritici* (Bjerk.) Wint. only, and had been collected by the writer at Winton in February, 1924. Samples of the four wheats were separately put through the various treatments in as identical a manner as possible—300 seeds from each sample being put to germinate* in the laboratory at approximately the same time as the remainder were being sown at the Ashburton Experimental Farm. The Pearl and the Hunter's were sown in the autumn, the Purple-straw and Solid-straw Tuscan in the spring. The ground used for the experiments had not carried wheat for at least seven years. The seed was sown in rows $5\frac{1}{2}$ yards long, with 1 ft. between rows, each row taking 100 seeds spaced 2 in. apart. A piece of flexible wire rope, with permanent marks at each 2 in. and a spliced loop at one end, was used both to line out the drills and to locate the exact position for each seed—the latter being sown by hand. This method is quick and accurate, since, the seed being visible during the whole operation, mistakes are readily noticed. The exact position of each seed is also found at any subsequent time by slipping the loop over the permanent marker-peg and stretching the rope along the row. Thus in the subsequent counting operations each row may be divided into any desired number of subdivisions to facilitate statistical examination of the results. In the experiments recorded here the 25, 50, and 75 marks were given extra prominence, thus dividing each sown row of 100 seeds into four equal parts. Each treatment was given four rows, a total of 400 seeds, and the results recorded separately on each of the sixteen divisions thus made and calculated as percentages on twenty-five seeds. The Probable Error of each of the mean results tabulated was computed on these lines, but, since statistical examination

* All the laboratory germinations here recorded were carried out by the Seed Analyst, Mr. N. R. Foy, and his assistants, Messrs. Cooch and Traill.

using this factor does not materially alter the obvious comparative significance of the data there given, the writer has refrained from further complicating the already rather overloaded tables. The data, however, will be gladly supplied to any worker to whom they may be of interest. Between each four rows of treated seed two rows of untreated seed from the same original sample were sown and counted in the same manner. The tables are presented in the order of sowing.

DISCUSSION OF TREATMENTS.

COPPER CARBONATE.

Copper carbonate was brought into prominence as a control for stinking-smut by the publication in the *Agricultural Gazette of New South Wales*, in 1918, of the results of three years' experiments by Darnell-Smith and Ross. The favourable nature of these results has been in the main confirmed by subsequent workers, and to-day the copper-carbonate treatment is generally recommended by plant pathologists in Australia and in the United States of America for the control of stinking-smut. Copper carbonate is a simple chemical compound, insoluble in water, and is mixed with the seed in the form of dust. Several firms are now making copper carbonates specially adapted for seed-treatment, and three of these were used in the present experiments, viz.: No. 1—Corona Coppercarb, made by the Pittsburgh Plate Glass Company, Newark, New Jersey, U.S.A. This product contains about half the proportion of copper compared with the other two brands, and is used at a double strength—the makers claiming that this ensures better covering of the seed, and hence greater effectiveness as a fungicide. This material arrived too late for the autumn sowings, and so was used only with the two Tuscan wheats. The wholesale price, f.o.b. New York, is quoted at about 10d. per pound. No 2—Stauffer's Copper Carbonate, made by Wheeler, Reynolds, and Stauffer, San Francisco; New Zealand agent, G. J. Miller, Ferry Buildings, Auckland; wholesale price quoted at about 1s. 5d. per pound. No. 3—Copper-carbonate sample supplied by Bowden Bros. and Co., Ltd., Sydney, N.S.W.; wholesale price at Sydney, 1s. 3d. per pound; makers not known to writer.

Method of Treatment used in Experiments.—Smutted seed was shaken vigorously for two minutes in a closed container with copper-carbonate dust in amounts proportionate to 4 oz. to the bushel for No. 1 and No. 2A, and 2 oz. per bushel for No. 2 and No. 3. The treatment marked "Copper carbonate No. 2A" in the table is No. 2 (Stauffer's), used at the rate of 4 oz. per bushel of seed.

Summary of Experimental Results.—(*a.*) Effect on the smut: With the low to medium infections shown by the Pearl, Hunter's, and Purple-straw Tuscan, all three copper-carbonate treatments (with the exception of a single head in the Hunter's) completely controlled the smut. With the high infection shown by the Solid-straw Tuscan, control was not complete, though only about $\frac{1}{2}$ per cent. of the heads were diseased, as against about 30 per cent. with the untreated seed.

(*b.*) Effect on the wheat-plant: In field germination, vigour of seedling, and number of heads harvested no significant differences were shown between the copper-carbonate-treated and the untreated seed—what difference there was being slightly in favour of the former.

Practical Considerations.—The copper-carbonate-dust treatment has several important advantages over the bluestone and formalin methods at present in use in New Zealand. It is simpler, safer, less laborious, and can be done at any convenient time prior to sowing, since the treated seed does not specially deteriorate on keeping. It controls stinking-smut just as efficiently, and effects a considerable saving of seed, since only the minimum quantity need be sown in the safe knowledge that the seed is undamaged. The main disadvantages are that a special machine is necessary to ensure proper mixing of the dust and seed, that copper-carbonate dust is very unpleasant in its effects when inhaled by the operator, and that compared with bluestone and formalin the cost of the material is high. For the first of these disadvantages several special machines are now being made suitable for treating large quantities of seed, and for smaller quantities all that is really necessary is a box or barrel fitted with a tight lid and mounted so as to be capable of fairly rapid rotation. An old barrel churn within which has been fixed one or two baffle-plates is quite suitable. For the second objection a dust-mask or a wet sponge or cloth over mouth and nose will largely avoid the trouble. The cost for material should be about 2½d. per bushel of seed. The treatment could probably be most efficiently and economically done in conjunction with the various seed-cleaning plants– the farmer receiving his seed cleaned and treated ready for sowing.

BLUESTONE (COPPER SULPHATE).

Bluestone has been in use since the eighteenth century as a seed-treatment for stinking-smut, and is still perhaps the treatment in most general use in New Zealand. The experimental results here given merely confirm the experience of many investigators and of most farmers—namely, that the bluestone steep, while fairly efficient as a controllant of stinking-smut, causes a marked loss in germination and in vigour of the seedling.

Method of Treatment used in Experiments. — Smutted seed was immersed for ten minutes in solutions made up of 1 lb. bluestone to 10 gallons water and 1 lb. to 5 gallons respectively, allowed to drain in a wet mass for twenty minutes, and then spread out to dry. In each case half the seed was dipped, after treatment and before drying, in limewash made up of 1 lb. quicklime to 10 gallons water.

Summary of Experimental Results.—(*a.*) Effect on the smut: With the low smut infection showing in the autumn-sown Pearl and Hunter's, all the bluestone treatments gave complete control of the smut. With the Purple-straw Tuscan, showing a medium infection, the 1-to-10-gallon treatment failed to give complete control, though the 1-to-5 was still effective. With the high infection in the Solid-straw Tuscan, none of the bluestone treatments were entirely effective, though all reduced infection to small proportions. Liming slightly reduced the effectiveness of both solutions in controlling the smut.

(*b.*) Effect on the wheat-plant: All the bluestone treatments showed a depressing effect on the germination, vigour of seedling, and number of heads harvested. This effect was more marked with the older seeds of the Pearl, Hunter's, and Purple-straw Tuscan. The stronger solution did more damage than the weaker, and liming reduced the damage in both cases.

Practical Considerations.—The advantage and disadvantages of bluestone can be discussed most effectively in conjunction with formalin, and will be dealt with under the latter heading. Whether the subsequent lime-bath is worth while must be left to the individual judgment on the figures presented, but there is a strong case in its favour where the 1-in-5 solution is used.

FORMALIN.

Formalin was first suggested as a smut-controllant in 1895. The excellent results given by it in laboratory trials and experimental work led to its rapid rise in favour among plant pathologists, who have of recent years generally given it preference over the older bluestone. On the farms, however, the formalin treatment is, in general, looked on with some suspicion, a suspicion which the experimental results recorded below will not tend to allay. However, a considerable portion of the cereals sown in New Zealand are regularly treated by this method. Commercial formalin consists of a solution of the gas formaldehyde in water, the sample used in the present experiments containing 39·2 per cent. formaldehyde (analysis carried out by the Dominion Analyst, Wellington).

Method of Treatment used in Experiments.—Smutted seed was immersed for ten minutes in solutions made up of 1 pint formalin to 40 gallons water (1–320) and 1 pint to 60 gallons (1–480) respectively, allowed to drain in a wet mass for twenty minutes, and then spread out to dry on blotting-paper on the laboratory benches. When outwardly dry it was placed in paper packets for conveyance to Ashburton for sowing. The "presoak method" consisted in soaking the seed in water at room-temperature for six hours, then steeping for ten minutes in 1–320 formalin solution, and draining for twenty minutes, followed by a rapid rinse in water before spreading out to dry as described.

Summary of Experimental Results.—(*a.*) Effect on the smut: With the low infection in the Pearl and Hunter's, all the formalin treatments showed complete control of the smut. With the medium infection in the Purple-straw Tuscan, both the straight 1–320 and 1–480 steeps were completely effective, though a single smutted plant appeared in the presoaked 1–320. With the high infection in the Solid-straw Tuscan, on the other hand, the presoaked 1–320 was the only formalin treatment completely controlling the smut, the ordinary steep at 1–320 showing 0·1 per cent. of smutted heads and the 1–480 showing 0·5 per cent., as against over 30 per cent. in the untreated controls.

(*b.*) Effect on the wheat-plant: The straight formalin steep at both the 1–320 and 1–480 strengths proved extremely detrimental to germination and vigour of seedling, and this applies to all four wheats, although the injury to the older Pearl, Hunter's, and Purple-straw Tuscan seed was much greater than to the newer Solid-straw Tuscan. In view of the fact that some workers have used these treatments without causing material damage to the wheat-plant, it appears that possibly some factor or factors may have been introduced in the present experiments which greatly accentuated the damage normally occurring with the formalin steep. The point requires further investigation. The 1–480 steep proved less harmful to the plant than the 1–320. The presoak method, however, with the Pearl, Hunter's, and Purple-straw

Tuscan produced a slight improvement in germination and vigour of seedling over the adjacent untreated controls; with the Solid-straw Tuscan these results were only slightly inferior.

Practical Considerations.—The formalin steep may be considered as an alternative seed-treatment to the older bluestone steep. Both control stinking-smut very well, so that other considerations must decide the choice of the user. The present experiments, for the reason already stated, should be accepted with caution as a guide in the case of formalin, except in so far as they indicate the tricky nature of treatment carried out with this substance and the possibility of getting, through some unforeseen circumstance, a disastrously low germination in the crop. The best results are given by the presoak-formalin method. This treatment, although it involves some extra trouble, should be perfectly feasible in farm practice—the extra trouble being well repaid in the certainty of obtaining a good and healthy stand. Where the straight formalin steep is used it appears that a strength of solution 1–480 can be advantageously substituted for the 1–320 strength employed. Both bluestone and formalin are cheap and readily procurable, the cost of treatment being rather in the time and labour employed than in the price of material. It seems likely that both will be supplanted in the near future by some of the newer materials and methods.

HOT WATER.

The modified Jensen method was used in the single experiment tried with hot water. The method is indispensable as a controllant of loose smut, and has been claimed as equally efficient in the case of stinking-smut. It has not yet had any extended application for this purpose.

Method of Treatment used in Experiments.—The smutted seed was immersed in water at 63° F. for six hours, dipped for ten minutes in water at 125° F., and spread out on blotting-paper to dry.

Summary of Experimental Results.—(*a.*) Effect on the smut: With the low infection present in the Pearl, the treatment gave complete control, and with the higher infections, though not completely eliminating the smut, it reduced its incidence to small proportions, showing 0·9 per cent. of infected heads, as against over 30 per cent. in the untreated controls in the Solid-straw Tuscan. It will be noticed that it also controlled the small percentage of loose smut present in the Purple-straw Tuscan.

(*b.*) Effect on the wheat-plant: The treatment had a very depressing effect on the germination and vigour of seedlings with the older Pearl, Hunter's, and Purple-straw Tuscan seeds. With the new seed of Solid-straw Tuscan this effect, though still present, was reduced to small proportions.

Practical Considerations.—This method has not yet reached the stage of practical application in New Zealand, but there are features connected with it, and especially in regard to the simultaneous control of both smuts, that may yet bring it to the forefront in importance.

CLARKE'S WHEAT PROTECTOR.

This is a proprietary fungicide manufactured in England. The New Zealand agents are Harris Bros., Christchurch. It is widely used

Table 1.—Pearl.

NOTE.—200 seeds were sown for each control, 400 seeds for each treatment.

Treatment.	Date.		Percentage Germination.					Plants.			Heads.			Percentage Difference compared with Adjacent Controls.	
				In Field.											
				First Count.											
	Treated.	Sown.	In Laboratory.	Percentage.	PE. ±	Mean Height.	Final Count (Mature Plants).	Total.	Smutted	Percentage smutted.	Total.	Smutted.	Percentage smutted.	Total Heads.	Sound Heads.
	May, 1924.				*	In.									
Control		28	95·5	61·6	3·21	1·60	57·0	114	2	1·8	820	2	0·2	..	..
Copper carbonate No. 2A ..	26	28	96·0	79·2	2·00	1·72	71·7	287	0	0	2,126	0	0	+ 12·9	+ 13·2
Control		28	95·5	81·0	1·44	1·88	72·0	144	3	2·1	1,062	4	0·4	..	..
Copper carbonate No. 2 ..	26	28	96·0	70·0	1·84	1·81	69·5	278	0	0	2,118	0	0	+ 2·6	+ 2·9
Control		29	95·5	81·0	1·56	2·18	76·5	153	1	0·7	1,001	3	0·3	..	..
Copper carbonate No. 3 ..	26	29	96·5	83·2	1·28	2·01	78·7	315	0	0	1,883	0	0	— 3·7	— 3·5
Control		29	95·5	83·5	1·57	2·17	74·0	148	2	1·4	955	5	0·5	..	..
Bluestone, 1 lb. in 10 gals. ..	27	29	91·5	75·0	2·04	1·66	68·0	272	0	0	1,682	0	0	— 11·8	— 11·6
Control		29	95·5	85·5	1·44	2·27	78·0	156	3	2·0	954	8	0·8	..	..
Bluestone, 1 in 10, limed ..	27	29	94·5	82·5	1·32	1·86	78·2	313	0	0	1,698	0	0	— 8·0	— 7·4
Control		29	95·5	83·0	1·34	2·22	80·5	161	1	0·6	892	5	0·5	..	..
Bluestone, 1 lb. in 5 gals. ..	27	29	79·5	49·7	1·56	1·50	54·5	218	0	0	1,073	0	0	— 40·1	— 39·7
Control		29	95·5	87·0	1·08	2·35	77·0	154	2	1·3	901	5	0·5	..	..
Bluestone, 1 in 5, limed ..	27	29	95·5	70·0	1·00	1·75	71·0	284	0	0	1,484	0	0	— 12·9	— 12·5
Control		29	95·5	85·0	1·32	2·26	80·5	161	1	0·6	804	3	0·3	..	..
Uspulun	27	29	98·0	92·2	1·40	2·27	88·2	353	0	0	1,583	0	0	+ 3·9	+ 4·5
Control		29	95·5	85·0	1·45	2·28	76·0	152	0	0	719	0	0	..	..
Germisan	27	29	96·0	85·5	1·36	2·24	81·7	327	0	0	1,532	0	0	+ 2·2	+ 2·4
Control		29	95·5	82·5	1·80	2·25	79·5	159	0	0	779	0	0	..	..
Semesan steep	27	29	97·0	78·2	1·28	2·07	78·5	314	0	0	1,482	0	0	— 4·5	— 4·4
Control		29	95·5	82·0	1·83	2·10	77·5	155	2	1·3	774	4	0·5	..	..
Hot water	26	29	91·5	43·2	2·44	1·83	46·7	187	0	0	1,081	0	0	— 28·7	— 28·3
Control		29	95·5	80·5	1·83	2·07	71·5	143	1	0·7	744	3	0·4	..	..
Formalin, 1 pt. in 40 gals. ..	27	29	93·0	37·2	1·40	1·78	37·2	149	0	0	877	0	0	— 40·7	— 40·2
Control		29	95·5	81·5	1·84	2·09	71·5	143	3	2·1	735	8	1·1	..	..
Formalin, 1 pt. in 60 gals. ..	27	29	96·0	42·5	2·04	1·88	42·2	169	0	0	968	0	0	— 34·1	— 33·1
Control		29	95·5	84·5	1·44	2·06	80·0	160	6	3·7	735	11	1·5	..	..
Formalin, 1 in 40, presoak ..	27	29	97·5	81·5	1·10	2·16	77·7	311	0	0	1,417	0	0	— 3·3	— 1·9
Control		29	95·5	78·5	1·97	2·07	78·5	157	4	2·5	731	10	1·3	..	..
Clarke's Wheat Protector ..	27	29	68·5	48·5	1·45	1·79	44·5	178	0	0	977	0	0	— 31·4	— 30·1
Control		29	95·5	76·5	2·08	2·10	73·0	146	6	4·1	694	18	2·6	..	..
Semesan dust	26	29	97·5	84·5	1·16	2·14	81·0	324	0	0	1,392	0	0	+ 4·5	+ 8·7
Control		29	95·5	80·0		2·11	76·5	153	12	7·8	638	32	5·0	..	..

Table 2.—Hunter's.

Control		30	95·2	73·0	2·04	2·18	67·5	135	7	5·2	701	21	3·0	..	..
Copper carbonate No. 2A ..	26	30	92·5	69·7	1·76	2·13	69·0	276	1	0·4	1,429	1	0·1	+ 0·5	+ 3·1
Control		30	95·2	67·5	2·08	1·69	64·5	129	5	3·9	720	13	1·8	..	..
Copper carbonate No. 2 ..	26	30	96·0	68·2	1·44	1·86	70·0	280	0	0	1,456	0	0	— 2·0	+ 1·1
Control		30	95·2	70·5	1·80	1·95	68·5	137	8	5·8	766	30	3·9	..	..
Copper carbonate No. 3 ..	26	30	92·0	63·2	1·92	1·90	64·0	256	0	0	1,363	0	0	— 8·1	5·3
Control		30	95·2	62·5	2·03	1·86	63·5	127	4	3·1	718	13	1·8	..	..
Bluestone, 1 lb. in 10 gals. ..	27	30	83·5	51·7	1·48	1·68	57·7	231	0	0	1,235	0	0	— 16·0	— 14·6
Control		30	95·2	66·5	2·08	1·85	65·5	131	3	2·3	753	9	1·2	..	..
Bluestone, 1 in 10, limed ..	27	30	87·0	59·2	1·52	1·71	62·5	250	0	0	1,326	0	0	— 9·6	— 8·8
Control		30	95·2	61·5	1·81	1·78	62·0	124	2	1·6	714	6	0·8	..	..
Bluestone, 1 lb. in 5 gals. ..	27	30	56·5	38·2	1·44	1·43	43·7	175	0	0	1,204	0	0	— 13·5	— 11·7
Control		30	95·2	60·0	1·82	1·77	59·5	119	7	5·9	679	20	2·9	..	..
Bluestone, 1 in 5, limed ..	27	30	87·0	50·7	1·68	1·79	55·0	220	0	0	1,289	0	0	— 10·7	— 7·4
Control		30	95·2	72·0	1·64	2·22	70·0	140	9	6·4	765	31	4·0	..	..
Uspulun	27	30	91·5	77·7	1·32	2·13	75·0	300	0	0	1,435	0	0	+ 2·2	+ 10·1
Control		30	95·2	67·5	1·65	2·07	59·0	118	16	13·5	639	68	10·6	..	..
Germisan	27	30	95·0	71·2	1·72	2·16	68·0	272	0	0	1,407	0	0	+ 7·4	+ 20·6
Control		30	95·2	64·0	1·65	2·01	62·5	125	25	20·0	671	72	10·7	..	..
Semesan steep	27	30	95·0	64·8	1·32	1·93	65·0	260	0	0	1,335	0	0	— 0·2	+ 12·4
Control		30	95·2	62·5	1·82	1·98	61·0	122	20	16·4	667	74	11·1	..	..
Hot water	26	30	85·0	23·2	1·32	1·79	31·0	124	2	1·6	798	8	1·0	— 44·0	— 40·1
Control		30	95·2	66·5	2·00	2·07	67·0	134	11	8·2	760	36	4·7	..	..
Formalin, 1 pt. in 40 gals. ..	27	30	84·0	8·2	0·68	1·81	7·5	30	0	0	323	0	0	— 79·4	— 78·2
Control		30	95·2	70·5	1·84	2·03	66·5	133	9	6·7	814	48	5·9	..	..
Formalin, 1 pt. in 60 gals. ..	27	30	93·0	20·8	1·24	1·91	23·7	95	0	0	788	0	0	— 49·2	— 44·2
Control		30	95·2	62·0	1·80	2·03	62·5	125	18	14·4	737	88	12·0	..	..
Formalin, 1 in 40, presoak ..	27	30	95·0	62·8	2·32	2·09	63·0	252	0	0	1,429	0	0	— 1·6	+ 10·5
Control		30	95·2	62·0	1·90	2·10	59·5	119	17	14·3	716	69	9·6	..	..
Clarke's Wheat Protector ..	27	30	64·0	30·5	1·44	1·88	36·7	147	0	0	1,040	0	0	— 29·8	— 24·8
Control		30	95·2	62·0	2·06	2·01	61·5	123	6	4·8	767	26	3·4	..	..
Semesan dust	26	30	91·5	70·5	2·12	2·06	72·0	288	0	0	1,528	0	0	+ 8·8	+ 13·0
Control		30	95·2	61·5	..	2·07	60·5	121	6	4·9	636	22	3·4	..	..

* The Probable Error of each control is computed in combination with the next succeeding control.

Table 3.—Purple-straw Tuscan.

Treatment.	Date. Treated.	Date. Sown.	Percentage Germination. In Laboratory.	In Field. First Count. Percentage.	In Field. First Count. P.E. ±	In Field. Mean Height.	In Field. Final Count (Mature Plants).	Plants. Total.	Plants. Smutted.	Plants. Percentage smutted.	Heads. Total.	Heads. Smutted.	Heads. Percentage smutted.	Percentage Difference compared with Adjacent Controls. Total Heads.	Percentage Difference compared with Adjacent Controls. Sound Heads.	Loose Smut. Plants showing Loose Smut.
	Aug., 1924.					In.				*						
Control		7	89·2	54·5	1·70	3·61	50·5	101	10	10·0	608	51	8·4	..	..	1
Copper carbonate No. 1 ..	2	7	90·0	61·2	2·08	3·52	57·5	230	0	0	1,424	0	0	+ 8·8	+ 16·7	2
Control		7	89·2	57·5	1·18	3·57	53·5	107	5	4·6	700	34	4·9	..	..	0
Copper carbonate No. 2 ..	2	7	87·0	59·7	1·12	3·60	57·0	228	0	0	1,319	0	0	— 0·8	+ 9·6	2
Control		7	89·2	53·0	1·73	3·39	46·5	93	15	16·3	630	91	14·4	..	..	1
Copper carbonate No. 3 ..	2	7	84·0	58·8	1·52	3·26	49·5	198	0	0	1,261	0	0	+ 0·4	+ 11·7	3
Control		7	89·2	48·0	2·00	3·30	47·5	95	8	8·5	626	33	5·3	..	..	1
Bluestone, 1 lb. in 10 gals.	4	7	85·0	50·8	2·60	2·79	48·5	194	2	1·0	1,266	11	0·8	— 4·8	— 0·6	4
Control		7	89·2	60·5	1·79	3·16	55·0	110	6	5·6	704	31	4·4	..	..	3
Bluestone, 1 in 10, limed ..	4	7	86·5	52·2	1·96	2·97	52·2	209	2	1·0	1,319	15	1·1	— 8·5	— 4·8	4
Control		7	89·2	64·0	1·79	3·05	61·0	122	10	8·3	738	41	5·5	..	..	2
Bluestone, 1 lb. in 5 gals.	4	7	73·5	45·8	1·48	2·91	46·0	184	0	0	1,182	0	0	— 16·7	— 10·8	4
Control		7	89·2	53·5	1·66	3·36	53·0	106	11	10·4	682	54	7·9	..	..	1
Bluestone, 1 in 5, limed ..	4	7	77·5	52·2	1·32	3·13	52·7	211	0	0	1,326	0	0	— 2·1	+ 3·7	2
Control		7	89·2	49·0	2·26	3·23	51·0	102	4	4·2	672	21	3·1	..	..	6
Uspulun	4	7	82·0	72·8	1·84	3·46	68·5	274	0	0	1,478	0	0	+ 14·0	+ 18·6	3
Control		7	89·2	62·0	2·28	2·98	56·5	113	7	6·3	625	30	4·8	..	..	2
Germisan	4	7	86·0	64·2	2·28	3·45	61·7	247	0	0	1,512	0	0	+ 15·9	+ 23·1	4
Control		7	89·2	54·5	2·23	3·24	53·5	107	13	12·2	679	45	6·6	..	..	1
Semesan steep ..	4	7	87·0	64·5	1·92	2·97	61·5	246	0	0	1,438	0	0	+ 3·6	+ 8·5	3
Control		7	89·2	54·0	1·82	3·12	49·0	98	3	3·1	709	17	2·4	..	..	2
Hot water	1	7	82·0	35·2	1·72	2·88	34·7	139	3	2·1	1,155	13	1·1	— 23·0	— 19·2	0
Control		7	89·2	54·5	1·69	3·20	53·0	106	13	12·3	791	70	8·6	..	..	1
Formalin, 1 pt. in 40 gals.	4	5	81·0	18·0	1·68	2·53	18·7	75	0	0	776	0	0	— 54·6	— 45·8	0
Control		5	89·2	53·0	1·83	3·27	51·5	103	14	13·7	808	93	11·5	..	..	1
Formalin, 1 pt. in 60 gals.	4	5	81·5	29·0	1·84	2·80	28·2	114	0	0	1,062	0	0	— 28·3	— 21·3	1
Control		5	89·2	45·0	1·79	3·00	43·5	87	7	8·0	674	37	5·5	..	..	0
Formalin, 1 in 40, presoak	4	5	87·0	55·5	2·12	3·12	51·5	206	1	0·5	1,444	19	1·3	+ 9·4	+ 18·2	2
Control		5	89·2	46·5	1·75	3·11	45·0	90	16	18·0	646	77	11·9	..	..	1
Clarke's Wheat Protector	4	5	80·5	56·2	1·56	3·21	57·5	230	0	0	1,443	0	0	+ 3·7	+ 17·6	3
Control		5	89·2	57·0	1·82	3·16	54·0	108	14	13·2	745	84	11·2	..	..	2
Semesan dust	2	5	89·5	71·0	2·04	3·35	69·0	276	0	0	1,618	0	0	+ 15·1	+ 27·0	2
Control		5	89·2	61·0	..	3·35	58·0	116	13	11·6	661	48	7·2	..	..	4

Table 4.—Solid-straw Tuscan.

Control		7	98·8	94·5	1·04	4·28	91·5	183	80	43·7	861	270	31·3	..	..	..
Copper carbonate No. 1 ..	2.	7	98·7	92·2	0·88	4·11	91·5	366	4	1·1	1,708	9	0·5	— 0·1	+ 46·0	..
Control		7	98·8	93·5	0·94	3·96	87·5	175	85	48·5	849	272	32·0	..	..	..
Copper carbonate No. 2 ..	2	7	99·7	92·0	0·96	3·94	89·0	356	1	0·3	1,683	3	0·2	— 1·8	+ 39·1	..
Control		7	98·8	94·5	0·92	4·02	92·0	184	80	43·5	866	233	26·9	..	..	..
Copper carbonate No. 3 ..	2	7	98·3	93·0	0·60	4·01	88·2	353	3	0·8	1,735	12	0·6	+ 1·7	+ 41·3	..
Control		7	98·8	94·5	0·92	3·88	90·0	180	84	46·6	840	251	29·9	..	..	..
Bluestone, 1 lb. in 10 gals.	4	7	97·3	88·7	1·20	3·93	85·0	340	4	1·2	1,692	10	0·5	— 1·3	+ 47·4	..
Control		7	98·8	92·5	1·22	4·30	91·0	182	99	54·4	875	321	36·6	..	..	..
Bluestone, 1 in 10, limed	4	7	99·0	90·2	0·96	4·27	88·0	352	6	1·7	1,704	17	1·0	— 0·4	+ 56·3	..
Control		7	98·8	91·2	1·17	4·08	89·0	178	99	55·6	836	308	36·8	..	..	..
Bluestone, 1 lb. in 5 gals.	4	7	94·0	88·0	0·92	3·95	85·5	342	3	0·8	1,592	6	0·3	— 5·4	+ 54·1	..
Control		7	98·8	91·0	0·82	4·17	86·5	173	96	55·5	847	347	40·9	..	..	..
Bluestone, 1 in 5, limed ..	4	7	98·7	88·0	1·28	4·02	82·0	328	3	0·9	1·614	9	0·5	— 4·5	+ 50·7	..
Control		7	98·8	95·5	0·62	4·27	93·5	187	82	43·9	843	288	34·1	..	..	..
Uspulun	4	7	98·7	97·7	0·60	4·38	92·2	369	0	0	1,640	0	0	— 0·4	+ 53·0	..
Control		7	98·8	96·0	0·71	4·09	91·0	182	92	50·5	804	294	36·5	..	..	..
Germisan	4	7	98·0	95·0	0·84	4·14	91·7	367	0	0	1,684	0	0	+ 2·8	+ 61·9	..
Control		7	98·8	97·0	0·97	4·16	94·0	188	94	50·0	834	301	36·1	..	..	..
Semesan steep ..	4	7	98·3	94·7	0·93	4·19	91·7	367	0	0	1,711	0	0	+ 4·3	+ 69·8	..
Control		7	98·8	92·5	1·06	4·03	88·0	176	96	54·5	806	327	40·5	..	..	..
Hot water	1	7	98·6	87·7	1·60	3·90	85·2	341	8	2·3	1,611	15	0·9	— 2·5	+ 41·4	..
Control		7	98·8	88·5	0·95	3·96	86·5	173	55	31·8	847	195	23·0	..	..	..
Formalin, 1 pt. in 40 gals.	4	5	98·0	67·5	2·08	3·24	63·2	253	1	0·4	1,456	2	0·1	— 13·3	+ 18·9	..
Control		5	98·8	90·0	0·71	3·76	85·5	171	78	45·6	833	261	31·3	..	..	..
Formalin, 1 pt. in 60 gals.	4	5	98·7	77·0	1·24	3·48	73·2	293	2	0·7	1,456	8	0·5	— 13·1	+ 26·8	..
Control		5	98·8	94·0	0·48	4·08	93·0	186	80	43·0	844	268	31·7	..	..	..
Formalin, 1 in 40, presoak	4	5	98·7	91·2	0·44	3·96	89·5	358	0	0	1,639	0	0	— 1·9	+ 42·8	..
Control		5	98·8	90·0	0·82	4·07	90·5	181	89	49·2	827	255	30·8	..	..	..
Clarke's Wheat Protector	4	5	97·3	90·5	1·60	4·14	87·2	349	2	0·5	1,631	4	0·2	+ 1·1	+ 42·3	..
Control		5	98·8	93·0	1·15	3·94	90·0	180	74	41·1	785	215	27·5	..	..	..
Semesan dust	2	5	99·3	95·0	0·83	4·11	89·7	359	0	0	1,641	0	0	+ 2·7	+ 36·2	..
Control		5	98·8	87·5	..	4·01	87·0	174	54	31·0	813	177	21·7	..	..	..

* Percentage calculated after deducting loose-smutted plants from total.

throughout the South Island for the control of cereal smuts. It costs about 2d. per bushel of seed treated.

Method of Treatment used in Experiments.—This followed as closely as possible the directions printed on the packet. The smutted seed was thoroughly wetted with solution made up in the proportion of one part Protector to fifteen parts water. It was kept moist for one hour, and then spread out to dry on blotting-paper in the laboratory, later being put into paper packets for transport to the sowing-ground at Ashburton.

Summary of Experimental Results.—(*a.*) Effect on the smut: Complete control was obtained with the low and medium infection of the Pearl, Hunter's, and Purple-straw Tuscan. With the high infection of the Solid-straw Tuscan, 0·2 per cent. of smutted heads remained, as against about 30 per cent. in the controls.

(*b.*) Effect on the wheat-plant: This differed widely as between the Pearl and Hunter's sown in the autumn and the two Tuscans sown in the spring. With the former, Clarke's Wheat Protector had a very depressing effect on germination and vigour of the seedling, while with the latter the treated seed improved slightly in both respects over the untreated controls. This profound difference in behaviour is more likely to be due to some error in treatment of the Pearl and Hunter's than to the different dates of sowing. Further work is necessary to settle the point.

Practical Considerations.—The simple and concise directions for use printed on each packet are a great factor in the popularity of this well-known treatment.

USPULUN.

Uspulun is the trade name of a preparation of mercury chlorophenate manufactured by Friedr. Bayer and Co., Leverkusen, Germany. Reports state that it is widely used as a seed-disinfectant in Europe and South America. It is claimed for Uspulun that, while giving perfect control of stinking-smut, it not only does not injure the seed but actually improves both germination, vigour of plant, and yield. The British agents are Millwards Merchandise, Ltd., Manchester, and the price about 13s. per pound, or about 9¼d. per bushel of seed treated.

Method of Treatment used in Experiments.—This follows closely the directions of the makers. The smutted seed was steeped for one hour in a 0·25-per-cent. solution of Uspulun, and then spread out on blotting-paper to dry.

Summary of Experimental Results.—(*a.*) Effect on the smut: Complete control of stinking-smut was given by the Uspulun treatment in all the experiments.

(*b.*) Effect on the wheat-plant: The experiments fully bear out the claims of the makers that wheat-seed treated with Uspulun gives a higher percentage germination in the field and greater vigour in the seedling than untreated seed. With the older seed of Pearl, Hunter's, and Purple-straw Tuscan there was also an increase in number of heads harvested, but with the newer Solid-straw Tuscan a very slight reduction.

Practical Considerations.—The relative advantages and disadvantages of the three similar seed-disinfectants, Uspulun*, Germisan, and Semesan, will be considered together under the heading of Semesan.

GERMISAN.

Germisan is the trade name of a preparation of mercury-cresol-sodium cyanide manufactured by the Saccharin-Fabrik, Aktiengesellschaft, vorm. Fahlberg, List and Co., Magdeburg, Germany, the British agents being Ronsheim and Moore, London. Like Uspulun, it is claimed to control stinking-smut and stimulate the wheat-plant. The price is about 8s. per pound, or about 5½d. per bushel of seed treated.

Method of Treatment used in Experiments.—The smutted seed was steeped for half an hour in a 0·25-per-cent. solution of Germisan, and then spread out on blotting-paper to dry.

Summary of Experimental Results.—(*a.*) Effect on the smut: Complete control of stinking-smut was given by the Germisan treatment in all the experiments.

(*b.*) Effect on the wheat-plant: With the Pearl, Hunter's, and Purple-straw Tuscan the percentage germination was higher than that of the untreated controls; with the Solid-straw Tuscan it was slightly lower. In all, the vigour of the seedling was increased by the treatment, and the total heads harvested in all cases showed a substantial increase over adjacent controls.

SEMESAN.

Semesan is the trade name of an organic mercury compound manufactured by E. J. Du Pont de Nemours and Co., Wilmington, Delaware, U.S.A. The makers claim that, like Uspulun and Germisan, it will control stinking-smut and at the same time stimulate the wheat-plant. It can be used in solution as a steep, or as a dry powder mixed with the seed. The price is about 13s. 4d. per pound, or about 7d. per bushel by the steep method and about 10d. per bushel by the dry method.

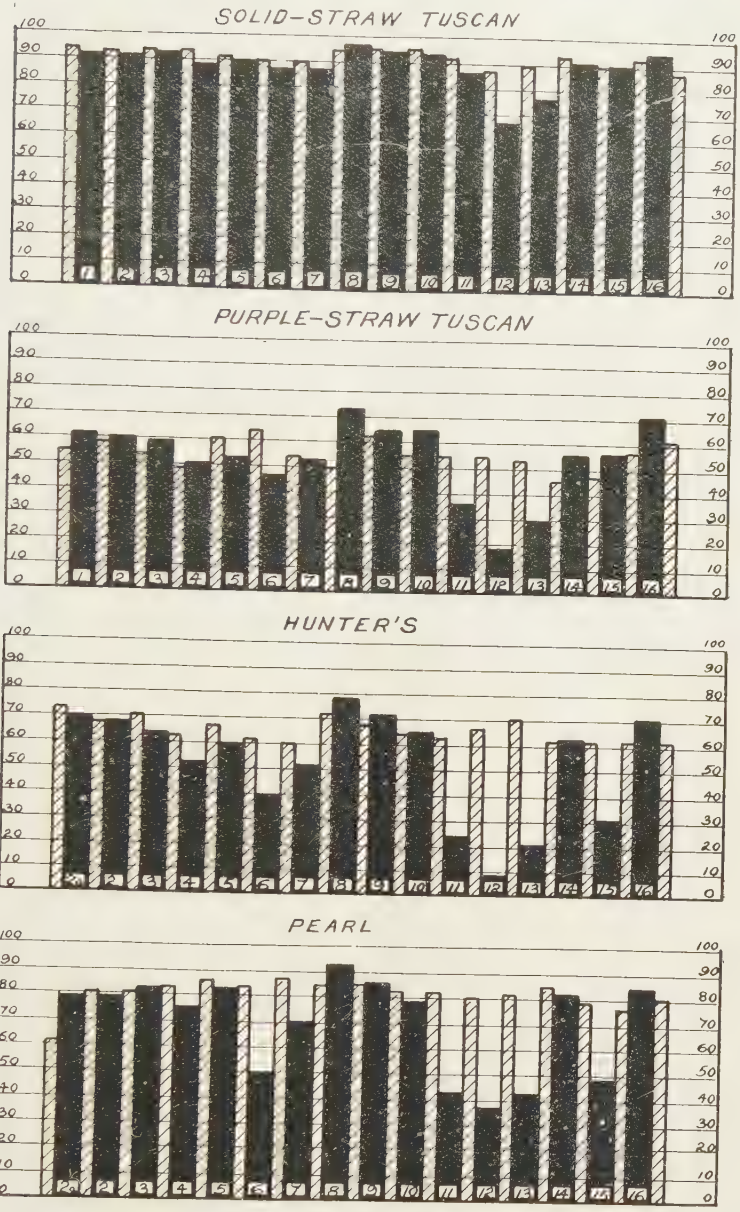
Method of Treatment used in Experiments.—(*a.*) Steep method: Smutted seed was steeped for one hour in a 0·2-per-cent. solution of Semesan, and then spread out on blotting-paper to dry.

(*b.*) Dry-dust method: Smutted seed was thoroughly shaken in a closed container with dry Semesan at the rate of 1 oz. per bushel of seed.

Summary of Experimental Results.—(*a.*) Effect on the smut: Complete control of stinking-smut was given by Semesan both by the steep and dry methods in all the experiments.

(*b.*) Effect on the wheat-plant: The differences in percentage germination and vigour of seedling between the seed treated by the steep method and the adjacent controls varied with the four wheat varieties, but on the whole were too small to be significant. In the total heads harvested the two Tuscans showed a substantial increase in favour of the treatment, and the Hunter's a very slight and the Pearl a greater decrease.

* The samples of Uspulun and Germisan used in these experiments were kindly procured for the writer by Dr. E. J. Butler, Director of the Imperial Bureau of Mycology, Kew, London.



GRAPHICAL PRESENTATION OF THE FIELD GERMINATIONS RECORDED IN TABLES 1–4.

Key to Numbers.—(1) Copper carbonate. Corona Coppercarb, 4 oz. per bushel. (2*a*) Copper carbonate, Stauffer's, 4 oz per bushel. (2) Copper carbonate, Stauffer's, 2 oz. per bushel. (3) Copper carbonate, Bowden Bros., 2 oz. per bushel. (4) Bluestone, 1 lb. in 10 gallons water. (5) Bluestone, 1 lb. in 10 gallons plus limewash. (6) Bluestone, 1 lb. in 5 gallons water. (7) Bluestone, 1 lb. in 5 gallons plus limewash. (8) Uspulun, steeped 1 hour in 0·25 per cent. solution. (9) Germisan, steeped ½ hour in 0·25 per cent. solution. (10) Semesan, steeped 1 hour in 0·2 per cent. solution. (11) Hot water, presoaked 6 hours at 63° F.; dipped 10 minutes at 125° F. (12) Formalin, 1 pint in 40 gallons water (1–320); dipped 10 minutes. (13) Formalin, 1 pint in 60 gallons water (1 480); dipped 10 minutes. (14) Formalin, presoaked 6 hours; dipped 10 minutes in 1–320 and rinsed. (15) Clarke's Wheat Protector, wetted with 1–15 solution. (16) Semesan, dusted at 1 oz. per bushel. Untreated (controls) indicated by cross-hatching.

The dry-dust method gave a substantial increase in percentage germination, vigour of seedling, and totals heads harvested in all the experiments.

Practical Considerations.—The three related disinfectants, Uspulun, Germisan, and Semesan, open up a new field in seed-treatment. In the present experiments not only are they perfect controllants for stinking-smut, but they have shown a remarkable stimulation of the growth of the plant. How far under farm conditions this stimulation will be reflected in increased crop remains to be decided. If the number of heads harvested per hundred seeds sown can be accepted as a guide, then, for instance, the dry Semesan treatment, giving an average increase over the untreated seed of 8 per cent., or $3\frac{1}{5}$ bushels on a 40-bushel crop, would amply repay the outlay in material and labour without any reference to smut-control. The long-time steep recommended is a serious practical handicap to the wet treatments, but this objection is eliminated with Semesan by the simple and apparently more effective dry-dust method.

Table 5.—Incidence of Stinking-smut in relation to Date of Sowing.

Date of Sowing.	Plants.			Heads.			Plants showing Loose Smut.	Ashburton Meteorological Records.		
	Total.	Smutted	Percentage smutted.	Total.	Smutted	Percentage smutted.		Week ending	Mean Temp. F.	Total Rainfall.
1924.								1924.		Inches.
..	..	..	..	..	..	..	..	May 17	50·7	0·04
May 17	133	2	1·5	1,048	11	1·0	6	,, 24	47·3	0·40
,, 24	113	2	1·8	1,056	8	0·7	3	,, 31	47·5	0·84
.. 31	107	16	15·0	803	98	12·2	2	June 7	41·6	0·69
June 9	108	38	35·2	815	230	28·2	2	,, 14	45·0	0·61
.. 14	95	27	28·4	692	181	26·1	1	,, 21	39·9	0·24
.. 21	47	5	10·6	507	67	13·2	0	,, 28	40·5	0·31
,, 28	56	10	17·8	538	105	19·5	0	July 5	42·1	0·06
July 5	74	12	16·2	612	97	15·8	0	,, 12	41·9	0·06
,, 12	90	9	10·0	685	56	8·2	2	,, 19	43·9	0
,, 19	101	15	14·8	683	82	12·0	1	,, 26	37·9	0·24
,, 26	75	8	10·6	473	57	12·0	1	Aug. 2	44·9	0·25
Aug. 2	103	4	3·9	640	18	2·8	1	,, 9	41·0	0·37
.. 9	114	19	16·6	521	70	13·4	0	,, 16	46·1	0·33
,, 16*	131	15	11·4	667	46	6·9	0	,, 23	42·9	0·09
,, 23*	130	19	14·6	570	51	8·9	1	,, 30	48·5	0·01
,, 30	79	4	5·0	554	26	4·6	0	Sept. 6	46·7	0·21
Sept. 9	80	2	2·5	498	10	2·0	2	,, 13	47·6	0
,, 13	63	2	3·2	313	5	1·6	1	,, 20	54·3	0
,, 20	124	0	0	538	0	0	8	,, 27	53·3	1·04

* In these two sowings the seeds were planted 1 in. apart, 400 seeds being sown instead of 200 as in the other sowings of the series.

Mean of Controls in Table 3.—Dates of sowing, August 5 and 7. Plants—total, 103·8; percentage smutted, 9·8. Heads—total, 688; percentage smutted, 7·2. Plants showing loose smut, 1·7.

The above data (Table 5) are founded on weekly sowings of 200 seeds of Purple-straw Tuscan wheat, 1923 harvest, inoculated in bulk with one part of smut spores (*Tilletia Tritici*) to 750 parts by weight of seed. The sowings were carried out by Mr. J. G. McKay at the Ashburton

Experimental Farm, and the temperature and rainfall records taken by Mr H. P. Clayton at the Meteorological Station distant about two miles over flat country from the place of sowing.

In the absence of soil temperature and moisture determinations on the spot, the only safe conclusions to be drawn from the table are that the percentage of infection given by similar seed varies widely according to conditions at the time of sowing, and that sowings made during the three winter months of June, July, and August are more likely to be heavily infected than those sown earlier or later.

The table is also useful in throwing some light on the wide differences in infection recorded for the four varieties in Tables 1–4. It is apparent that these differences are not necessarily due to a difference in varietal susceptibility, but in part at least may be caused by environmental differences during germination.

RIGHT HONOURABLE WILLIAM FERGUSON MASSEY, 1856–1925.

THE *Journal* records its sincere tribute to the memory of the late Prime Minister, who, though better known of late years in the wider policies of State, was so intimately associated with the great basic industry of the land. When, in 1912, Mr. Massey formed his first Ministry it was fitting that, a farmer himself, he should take the portfolio of Agriculture in addition to the Premiership. He thus became the sixth Minister of Agriculture, and continued to administer the Department for the following three years, when the advent of the National Government, in 1915, caused a redistribution of offices. During Mr. Massey's term the activities of the Department of Agriculture were developed in various directions, while a notable related measure of his regime was the creation of the Board of Agriculture. At this period he also held the portfolio of Lands with its wide rural scope. But Mr. Massey's direct influence on agricultural interests did not end in 1915. During the war period he was closely connected with the Imperial requisitions of our primary produce and related shipping affairs. More recently he became a force behind the export-produce-control movement. The welfare of the man on the land was ever to Mr. Massey a matter of true concern. His manifold service for the agricultural community will be kept in grateful remembrance.

QUEEN-BEE REARING.

NEW MATING-BOX TESTED AT RUAKURA.

A. B. TRYTHALL, Apiarist, Ruakura Farm of Instruction.

THE question of the most suitable mating-box has proved a prolific field for experiment ever since queen-rearing became a prominent part of apiary-work. The gist of the matter is to mate queens successfully with the least amount of attention and the minimum of worker bees.

During a lengthy experience in beekeeping I may claim to have tried practically every kind of mating-box that other beekeepers have advocated, and before describing my latest experiment it will be advisable to review some of the more prominent appliances that have been used previously.

The first and probably still the most commonly used form of mating-box is the ordinary three, four, or five Langstroth frame nucleus hive; and for practical purposes—particularly in the case of those beekeepers who only need to rear queens for their own requirements—this is still one of the best and safest boxes to use for the purpose. These nuclei, however, require a great many bees for stocking, and as queens can be mated in much smaller nuclei containing far fewer bees it is only natural that the breeders of large numbers of queens should have been constantly experimenting to discover how small a box, with how few bees, can be used to do the same work easily and well.

Over twenty years ago an American beekeeper named Pratt, who wrote for the bee journals and issued a series of pamphlets on queen-rearing under the *nom de plume* of "Swarthmore," used mating-boxes of very small dimensions. These boxes contained two frames little larger than 1 lb. section frames, and were stocked with a queen-cell and a breakfast-cupful of bees only. Many beekeepers, including myself, tried these so-called "baby nuclei," but with only partial success, the fault being that in many instances the bees swarmed out with the young queen when she took her mating flight—and never returned.

The A.I. Root Company (U.S.A.), recognizing that "Swarthmore" had gone to too great an extreme, designed what is known as the "Root Twin Baby Nuclei," which consists of a box $9\frac{1}{4}$ in. by $8\frac{1}{2}$ in. by $6\frac{5}{8}$ in. deep, inside measurement. This is divided in the centre by a fixed partition, forming two compartments with separate entrances at each end. The frames have sliding tin ends to rest on the rabbets of the hive. The sliding ends when pushed back enable three of these frames to be fitted into a Langstroth frame, so that the combs could be worked out and brooded in an ordinary hive. When brooded and stocked with honey two of the small frames are placed in each compartment of the twin baby nuclei, together with a queen-cell and about a pint of bees.

I have used these twin baby nuclei quite successfully at Ruakura, and they are still used in America by many queen-rearers, but for several reasons have not been so successful as was expected. Among

other disadvantages are the following: (1) They are too small to winter as separate units, and therefore require to be restocked every season; (2) owing to the small capacity of the frames, constant supervision is necessary to prevent starvation on the one hand, or undue honey-glutting of the frames on the other; (3) unless stocked at an out-yard and released in the home yard (or *vice versa*) there is the risk of too many bees deserting; (4) the trouble entailed in making the small frames and getting them worked out in Langstroth frames and afterwards transferred to the baby nuclei.

THE NEW MATING-BOX.

During the last two seasons I have been experimenting with a nucleus hive made out of benzine- or kerosene-case ends, and of dimensions to take ten frames the size of a Langstroth frame cut in half horizontally. These hives have provision for four entrances, one on each side and end, and are capable of being divided into any number of compartments, up to four, by slipping in movable division-boards made of three-ply wood flanged with strips of rubber tubing to provide a tight-fitting cushion. The floor-board is movable, but fastened in position when necessary with four wire pins. Entrance shutters are provided to close any compartments not in separate use.

Details of Construction.

Details of the construction of this hive are as follows:—

Floor-board: This is 19$\frac{3}{8}$ in by 11$\frac{3}{4}$ in., and composed of two benzine-case ends cut to size and nailed on 1 in. bearers all round. The scraps cut off provide more than enough to form short legs, which are nailed to the under-side. On top of the floor-board, 1 in. from each end, are nailed pieces of wood 1 in. square and the width of the hive. In the centre of each of these is cut a small hive-entrance.

Body-box: Sides—one complete benzine-case end each, with frame rabbet $\frac{7}{16}$ in. deep by $\frac{3}{8}$ in. cut out. Ends—one case end each, reduced to 11$\frac{5}{8}$ in. When nailing together let the ends lap the sides, instead of letting the sides lap the ends. In the ends cut entrances corresponding to those in the floor-board. At each side bore auger-holes 9 in. from end of box (outside measure), such holes being placed diagonally (not opposite) to each other. The box should fit comfortably between the pieces on each end of the floor-board. Bore four gimlet-holes through these end pieces and the hive ends, and insert fence-wire pins to hold the box and floor-board firmly together.

The division-boards of the box are made of three-ply wood, 9$\frac{1}{2}$ in. wide by 9$\frac{1}{4}$ in. deep. Along the bottom and projecting $\frac{1}{2}$ in. from the wood is a strip of motor-car inner-tube rubber 10$\frac{1}{2}$ in. long, and similar pieces 9$\frac{1}{4}$ in. long project in the same way down each side. These are tacked firmly to the three-ply with strips of thin wood. A similar strip runs along the top edge, with ends projecting to fit the rabbets of the hive. The gist of the whole arrangement is to keep the bees not only from passing the division-boards but to prevent any communication between the compartments, and yet for the division-boards to be easily removable and not subject to propolization.

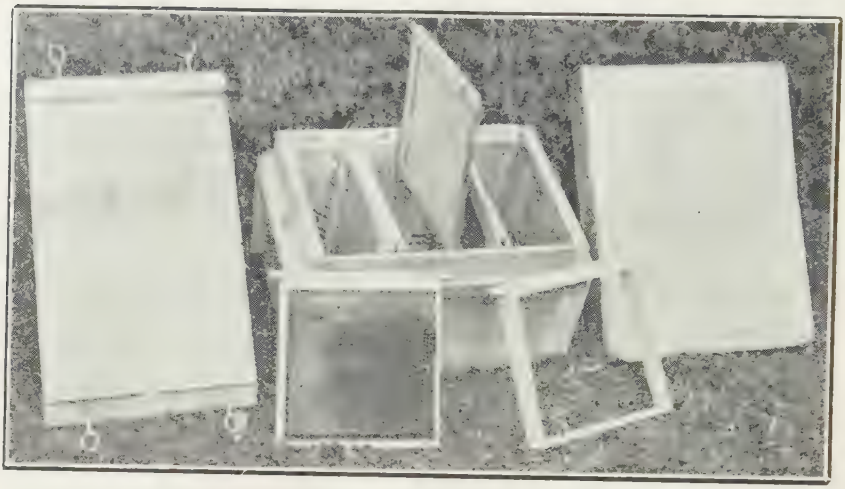


FIG. 1. SHOWING THE PARTS OF THE NEW MATING-BOX AND HIVE.

FIG. 2. THE NUCLEUS HIVE IN USE BY MR. TRYTHALL AT RUAKURA APIARY.

The clock-faces on each compartment of hive are devised to indicate condition of nuclei when last examined, and thus largely save note-taking. The meanings attached to each hour (which are memorized) are as follows: (1) Empty; (2) query; (3) queen-cell required; (4) queen-cell given; (5) cell refused by bees—own cell built; (6) cell hatched; (7) young queen seen, but not yet laying; (8) no queen—fertile workers present; (9) queen laying—untested; (10) mismated queen; (11) tested queen; (12) more bees or stores required. The minute hand pointing to any one of first thirty minutes indicates respective day of month when last examination made; pointing to any one of second thirty minutes it indicates necessity of examining hive again at that future date. Hands are readjusted at completion of each examination as required.

[*Photos by H. Drake.*

Roof: This is made with $\frac{7}{8}$ in. square bearers all round, giving inside measurements of $16\frac{1}{16}$ in. by $11\frac{7}{8}$ in. Cover with double thickness benzine-case side timber, and over all cover with benzine-tin sheet cut as shown in Fig. 1. Flatten out the tin, and solder small V-shaped pieces into the breaks on each side. Give $1\frac{1}{2}$ in. lap to the tin all round. The double thickness of roof-timber gives weight and stability, with less liability to being blown off, and also more protection against summer heat and winter cold. Instead of hand-holes for lifting, a flange of $\frac{7}{8}$ in. square wood is run right round the outside of the hive-body 1 in. below the top. The roof-sides rest on this flange, which also tends to further prevent the roof from being blown off if the hive is exposed to strong winds.

The hive should be put together with all case-marks turned to the inside. Paint all over with three coats, giving the tin part of the roof a coat of red-lead paint inside before nailing on so as to prevent it rusting from the inside. The final product is a neat, durable, compact hive which will last for years.

Stocking and Management.

To stock the mating-box take from some other hive or hives five Langstroth frames containing brood and stores, and with a fine saw cut them in two exactly in the centre. Then nail on to each half another end bar on which has been previously nailed a projecting end to rest on the rabbet on the hive-side. Place the ten half-size frames in the hive, and cover with quilt and roof. Pull out the wire pins, lift the body off its floor-board, and place it crossways over the excluder on a strong colony of bees, covering the vacant space with a board 16 in. by 8 in. The young nurse-bees from the strong hive will immediately take charge of the brood, and the nucleus hive can be moved back on to its own floor-board the next day, and be placed on a new stand. The young bees, never having flown, will remain where they are put.

The hive is now ready to receive one, two, three, or four queen-cells according to requirements. If more than one queen-cell is given, divide the hive accordingly by slipping in one or more of the three-ply rubber-cushioned dividing-boards, and open the required number of entrances. These division-boards take up very little space, and even if one compartment is reduced to two frames only in size it has still much more capacity than one of the Root baby nuclei. If any compartment becomes weaker in bees than another, turn the hive round, bringing the entrance to the weakest portion opposite the strongest flow of field-bees. But care should be taken to do this when no young queens are due to fly, or matters will be complicated for them.

As the close of the season approaches and surplus queens are being used up for requeening other hives or for sale purposes, it is the simplest matter to remove a queen from one of these compartments and the following day to take out a partition, thus uniting its bees and brood with the next. This in turn is treated likewise, until one queen only is left in possession of the entire hive, in which she should be able to winter easily and come out strong in spring. Then the partitions and queen-cells are put in again with the minimum amount of trouble, nuclei being all ready at the start without having to restock them every spring.

Advantages summarized.

The points in favour of this mating-box are many, and may be summarized as follows: (1.) It is made almost entirely of waste material —benzine-case timber and container-tin. (2.) Well made and painted, it is a good-looking hive, and very substantial, durable, weatherproof, and warm. (3.) It is ideal for wintering. (4.) It is convenient to hive small or medium-sized swarms in. (5.) Its elasticity of method; if the beekeeper has surplus queen-cells he can use them by placing division-boards in the box; as queens are used the division-boards are taken out and the compartments united.

Another easy way to provide nuclei is to fill the half-size frames with foundation, and after filling the hive with them to place a swarm in possession. Later on, when the swarm has built out and brooded the frames, partitions can be inserted and queen-cells given.

IMPORTATION OF FERTILIZERS IN 1924–25.

ANNUAL STATISTICS AND NOTES.

F. T. LEIGHTON, Analyst, Chemistry Section, Agriculture Department.

STATISTICS of artificial fertilizers imported into New Zealand during the year ended 31st March, 1925, are now (by the courtesy of the Comptroller of Customs) available for study, and, with other data, have been compiled for the *Journal* in the accompanying tables.

The most notable feature of the year's returns is the marked increase in the importation of phosphatic fertilizers. Of rock phosphate or guano (the terms may now be regarded as practically synonymous in trade) 32,000 tons more were imported than in 1923–24, or over 40 per cent. Of the 108,000 tons of rock phosphate imported probably about one-half was utilized in the manufacture of superphosphate, and the remainder marketed as finely ground raw phosphate, either alone or in proprietary mixed fertilizers. As stated in the *Journal* for May, 1924, much of the efficacy of rock phosphate depends on the fineness of grinding, and users are invited to forward to the Department's Chemical Laboratory, Wellington, for examination and report, any samples they consider are not ground to the requisite fineness, which may be taken as equal to that of good-quality basic slag.

The Dominion's demand for superphosphate is now completely satisfied by New Zealand manufacturers, the aggregate importations for the past three years amounting to only 265 tons.

The importations of basic slag for the past year also constitute a record. The greater part (about two-thirds) of the slag received was of Belgian origin, the remainder, except for a few hundred tons, coming from the United Kingdom. No American basic slag has been imported this year. So far as can be determined by chemical analysis of the samples received, practically no low-grade slag is coming to New Zealand, samples examined being of satisfactory quality in total and citric-acid-soluble phosphate, also in fineness of grinding. No samples of fluorspar slags, which contain some of their phosphate in a form which is of little value to plants, have come under the notice of the Department during the year. Field experiments have shown that basic slags

in the making of which fluorspar has been used are often of comparatively small manurial value, while chemical analysis reveals that only a small percentage of the total phosphate is soluble in the official 2 per cent. citric-acid solution.

Potash salts are also being imported in increasing amounts, this year's importations being 50 per cent. above those for the preceding period.

The very small demand in New Zealand for soluble nitrogenous fertilizers is indicated by the returns of sulphate of ammonia and nitrate of soda imported. The small quantities which have come to hand are probably used almost entirely in intensive cultivation (market gardening, &c.), and in the preparation of special proprietary mixtures.

TABLE 1.—SUMMARY OF FERTILIZER IMPORTATIONS, 1924–25 AND 1923–24.

Fertilizer.	Quantity.		Declared Value.	
	Year 1924–25.	Year 1923–24.	Year 1924–25.	Year 1923–24.
	Tons.	Tons.	£	£
Bonedust	2,452	4,158	23,210	39,541
Bone-char	396	50	1,756	447
Basic slag	45,682	39,632	137,213	124,565
Superphosphate	10	255	29	985
Rock phosphate (raw) and guano	108,163	76,517	150,340	108,119
Egyptian basic phosphate ..	8,530	5,996	25,313	18,138
Kainit	4,001	3,975	9,137	9,557
Muriate of potash	2	..	17	..
Sulphate of potash	1,126	863	11,574	9,241
Potash, other	2,287	290	8,321	1,314
Gypsum	354	1,979	574	2,583
Sulphate of ammonia	841	842	13,158	5,439
Nitrate of soda	816	748	9,751	9,646
Sulphate of iron	96	63	1,043	549
Fertilizers unspecified	12	15	1,371	265
Totals	174,768	135,383	392,807	330,389

NOTE.—With regard to the "declared values" given above, the Comptroller of Customs supplies the following explanation: "The value for duty is defined as the fair market value in the country whence the goods are imported, plus 10 per cent. As the addition of 10 per cent. does not cover the present freight, insurance, and other charges, the statistical value is less than the actual landed value."

TABLE 2.—IMPORTS OF THE PRINCIPAL PHOSPHATIC FERTILIZERS, 1915–25.

Year ended 31st March.	Bonedust.	Basic Slag.	Superphosphate.	Raw Rock Phosphate and Guano.	Egyptian Basic Phosphate.
	Tons.	Tons.	Tons.	Tons.	Tons.
1915	7,966	29,385	54,190	23,983	Nil.
1916	10,059	10,339	58,013	39,366	2,026
1917	10,386	6,660	31,962	24,993	8,614
1918	6,363	10	37,157	37,037	11,225
1919	3,468	Nil	21,400	31,351	Nil.
1920	6,272	2,759	15,842	38,861	15,000
1921	4,440	10,823	40,731	70,208	10,810
1922	4,063	13,488	3,140	45,956	Nil.
1923	2,446	19,641	Nil	69,591	,,
1924	4,158	39,632	255	76,517	5,996
1925	2,452	45,682	10	108,163	8,530

TABLE 3.—IMPORTATION (IN TONS) OF PRINCIPAL ARTIFICIAL FERTILIZERS FOR YEAR ENDED 31ST MARCH, 1925, SHOWING COUNTRIES OF DEPARTURE AND NEW ZEALAND PORTS OF ENTRY.

New Zealand Port of Entry.	Australia.			Chile.	India.	Pacific and Indian Ocean Islands.		United Kingdom.			Belgium.		France.		Germany.		Egypt	Netherlands.
	Nitrogenous Manures.	Bonedust and Chardust.	Gypsum.	Nitrate of Soda.	Bonedust.	Name of Island.	Rock Phosphate.	Nitrogenous Manures.	Basic Slag.	Potash.	Basic Slag.	Potash.	Basic Slag.	Potash.	Basic Slag.	Potash.	Phosphate.	Basic Slag.
Auckland ..	405	1,052	30	765	1,475	New Caledonia ..	1,817	100	6,700	1,085	19,220	174	105	298	250	2,175	998	201
						Nauru	52,720											
						Ocean	11,379											
						Makatea ..	605											
New Plymouth ..	..	..	..	..	..	New Caledonia ..	958	..	9,819	842	2,271	..	..	..	..	660	..	..
Wanganui ..	..	..	..	..	..	New Caledonia ..	712	..	..	..	..	..	..	..	..	..	..	..
Napier	..	..	..	..	..	..	..	..	150	25	..	..	..	..	..	15	..	..
Wellington ..	21	..	15	50	70	..	..	..	2,932	161	2,320	25	..	80	..	240	3,590	..
Nelson	..	..	..	..	..	..	..	..	330	..	102	..	..	66	..	..	..	..
Lyttelton ..	225	..	..	..	..	Nauru	20,469	..	150	..	85	..	..	465	..	97	1,100	..
						New Caledonia ..	700											
Timaru	..	..	..	..	..	New Caledonia ..	714	..	..	70	..	..	..	105	..	..	..	..
Dunedin ..	38	..	309	..	..	Nauru	9,310	25	50	115	75	..	..	140	..	220	1,500	..
						New Caledonia ..	1,415											
Invercargill ..	22	251	..	1	..	Nauru	5,500	..	439	75	408	..	..	210	..	75	1,342	..
						New Caledonia ..	1,839											

NOTE.—For the previous year's corresponding table see *Journal* of May, 1924.

THE OFFICIAL SEED-TESTING STATION.

RECORD OF OPERATIONS FOR 1924.

NELSON R. FOY, Seed Analyst, Biological Laboratory, Wellington.

FOR the twelve months ended December, 1924, 8,266 samples were submitted to the Seed-testing Station for germination tests. Of these samples 1,236 were also analysed for purity. In addition, approximately 500 miscellaneous laboratory tests were made, and 125 samples were received from farmers. A decrease on the number tested for the previous year is shown, this probably being attributable to the fact that the seed-export trade was not so active during 1924, particularly in perennial rye-grass. Crested dogstail may be excepted, as New Zealand seed of this species was in considerable demand overseas.

Table 1 shows the movement of the testing-work throughout the year, and Table 2 gives an indication of the activities of the seed trade compared with 1923.

Table 1.—Number of Samples received in the Different Months, 1924.

Month.	Number.	Month.	Number.
January	556	July	469
February	748	August	699
March	866	September	1,014
April	853	October	556
May	938	November	506
June	650	December	411

Table 2.—Number of Samples received of the various Species, 1923 and 1924.

Seed.	1924.	1923.	Seed.	1924.	1923.
Lucerne	103	97	Paspalum	56	34
Alsike	74	74	Poa pratensis	51	46
White clover	293	325	Prairie-grass	19	21
Cow-grass and red clover	439	405	Other grasses	72	160
Crimson clover	25	36	Japanese millet	32	40
English trefoil	27	34	Oats	42	42
Lotus major	50	63	Other cereals	35	18
Other clovers	49	36	Mangolds	208	184
Perennial rye-grass	1,031	1,537	Turnips	417	413
Italian rye-grass	255	370	Swedes	133	278
Western Wolths	176	201	Rape	86	145
Timothy	69	76	Kale (Buda and Thousand-headed)	39	48
Crested dogstail	641	90			
Danthonia spp.	47	81	Chou moellier	34	..
Brown-top	54	78	Tree-seeds	20	16
Chewings fescue	490	524	Flower-seeds	24	20
Meadow-fescue	33	35	Vegetables (other than peas)	410	325
Meadow-foxtail	49	43	Peas	260	179
Yarrow	12	..	Tares, vetches, &c.	16	26
Cocksfoot	516	610			

GRASSES.

The average percentage purity and germination of the main grasses are shown in Table 3.

Rye-grasses.—The averages for perennial Italian and Western Wolths are all higher than those recorded for 1923, as was also the yield at harvest. In contrast to 1923 the demand for seed did not equal the supply, and consequently there has been in some districts a fair carry-over into 1925. Table 4 shows the average growth of perennial rye-grass by districts. Sandon is again disappointing, and the failure of the seed from this district to germinate satisfactorily is being investigated at this Station.

Cocksfoot.—Fair average quality characterized this seed. Danish generally is of a higher growth than New Zealand seed, the average shown in Table 4 being thrown out by a few very inferior lines. A reduction every year in the yields of Akaroa seed is followed naturally by an increase in the importation of Danish. This is a regrettable state of affairs, but is inevitable with the increase of dairying on Banks Peninsula. The more continuous grazing not only tends to lessen seed-production, but, given sufficient time, will alter the constituent character of these famous Cocksfoot pastures.

Timothy.—All imported seed of this species was of good quality.

Crested Dogstail.—The dogstail crop was of good average quality. Southern seed, however, did not hold its germination capacity very well abroad. This seed is famous for its colour, and English buyers are beginning to discover that colour is not always the most desirable characteristic of dogstail. A light colour usually denotes either immaturity or a forced ripening out of the head. Such seed rarely holds its growth for any great length of time, and shipment conditions probably tend to accentuate this feature. Southland growers would do well to leave the seed in stook a week or so longer, or, where practicable, delay cutting a few days.

Danthonia.—The quality was fair. A large number of very rough samples were received, some containing up to 60 per cent. of hair-grass, rye-grass, and inert matter (straws, &c.). There now appears to be a tendency to label this seed with the additional specific names *pilosa* or *semiannularis*, reserving the generic name for mixtures of the two species.

Brown-top.—The quality was irregular, ranging from extraordinarily poor to particularly good. Some of the samples did not contain sufficient filled seed to enable the standard germination test to be made. It is high time that the blower was put on to all brown-top. In this connection it is reported that some firms are dressing this seed up to its full weight for export. If the American trade is to be encouraged and retained a fancy grade of seed will have to be used for the purpose. In the dressed state brown-top is superficially the same in appearance as American red-top, and farmers when buying the cleaned seed should make sure it is New Zealand brown-top that is being offered to them. Determinations of Agrostis species are made gratis at this Station.

Chewings Fescue.—The samples received were of good average quality. This seed is important mainly from an export point of view, being now of little account in New Zealand pastures generally.

Table 3.—Average Percentage Purity and Germination of the Main Grass-seeds.

Seed.	Average Percentage of Impurities.	Percentage of Germination.			Percentage of Samples germinating between					
		Highest.	Average.	Lowest.	0–50.	51–60.	61–70.	71–80.	81–90.	91–100.
Perennial rye-grass ..	2·7	100	86	8	3	2	8	16	28	43
Italian rye-grass ..	0·4	100	87	3	3	3	5	8	18	63
Western Wolths ..	0·2	100	90	9	5	1	1	1	16	70
Timothy	0·5	96	90	28	3	0	2	6	14	74
Crested dogstail ..	0·7	100	87	10	3	1	3	10	31	53
Cocksfoot	3·3	97	62	0	20	20	24	21	14	2
Brown-top ..	3·0	96	61	8	28	15	15	18	18	3
Chewings fescue ..	1·0	97	80	1	6	3	8	20	39	25
Meadow-fescue ..	0·2	97	58	0	50	3	6	12	12	18
Poa pratensis ..	0·5	83	52	2	32	42	18	6	2	2
					0–20.	21–30.	31–40.	41–50.	51–60.	61–100.
Meadow-foxtail ..	5·0	85	30	3	26	28	24	10	2	2
Danthonia spp. ..	17·8	83	36	2	24	24	2	3	2	10
Paspalum	0·2	84	36	0	40	9	4	5	20	23

Table 4.—Average Percentage Purity and Germination of Perennial Rye-grass, Crested Dogstail, and Cocksfoot, according to District of Origin.

Seed.	Average Percentage of Impurities.	Percentage of Samples germinating.		Average Germination.	Number of Samples.
		81–90.	91–100.		
Perennial Rye-grass.					
Southern	0·8	33	35	84·3	377
Canterbury	0·3	15	66	91·0	226
Sandon	0·1	36	28	82·4	157
Hawke's Bay	0·5	8	84	93·5	61
Poverty Bay	0·5	5	80	94·0	23
Crested Dogstail.					
Southern	0·8	34	50	88·0	486
Sandon	0·1	24	65	90·2	75
Cocksfoot.					
		51–70.	71–80.	81–100.	
Plains	2·0	40	40	16	68·2	24
Akaroa	1·3	58	16	11	62·8	100
Danish	1·2	36	22	25	66·2	152

Paspalum Dilitatum.—Quality in general was good, some samples growing over 90 per cent. All the high-grade seed received was of Australian origin, most of these samples being direct from Australian seed firms.

Poa Pratensis.—Samples were of fair average quality, most of the seed being of American origin. The few samples of New-Zealand-grown seed all germinated over 90 per cent.

Other Grasses, &c.—Average germination percentages of the species included under this heading were as follows: Fine-leaved fescue, 50·0; tall fescue, 74·5; sheep's fescue, 58·5; red-top, 75·2; Indian doob, 82·0; Poa nemoralis, 49·0; Poa trivialis, 44·0; Yorkshire fog, 87·8; yarrow, 67·8.

Table 5.—Occurrence of the Main Impurities of the Grasses.

Impurities.	Perennial Rye-grass.	Italian Rye-grass.	Western Wolths.	Timothy.	Crested Dogstail.	Cocksfoot.	Brown-top.	Chewings Fescue.	Danthonia.
Hair-grass	74	58	57	..	29	23	50	36	100
Goose-grass	72	71	55	..	..	69	..	13	40
Catsear	25	10	5	..	61	17	58	80	65
Perennial rye-grass ..	..	..	..	..	75	93	14	76	80
Sweet vernal	11	3	1	..	20	1	28	49	75
Rib-grass	13	16	16	10	7	71	22	4	85
Yorkshire fog	23	20	22	..	90	62	28	64	80
Sorrel	35	39	30	55	23	34	65	26	45
Curled dock	11	13	..	..	..	17	..	2	..
White clover	15	12	5	40	15	15	..	4	..
Creeping-buttercup ..	1	..	..	..	..	17	..	..	.
Californian thistle ..	..	..	2	..	29	..	..	2	..
Hawkweed	..	..	6	..	36	9	14	..	..
Ergot sclerotia	35	10	..	30	24	7	36	10	..
Ox-eye daisy	..	..	..	..	..	10	7	..	.
Cocksfoot	22	23	11	..	19	..	..	21	
Fat-hen	..	..	..	50	..	5	..	..	..
Italian rye-grass.. ..	73	..	..	..	..	14	..	..	..
Suckling-clover	24	38	22	..	..	9	29	4	42
Crested dogstail	19	3	..	..	..	3	7	20	37
Chickweed	1	..	..	..	7	3	42	..	..
Field-madder	..	1	..	..	..	..	..	..	..
Alsike	4	..	..	100	2	1	..	1	..
Lotus spp.	1	..	2	..	1	..	93	..	2
Cow-grass	4	1	5	10	1	20	7	1	4
Toad-rush	2	2	..	1	4	2	79	3	6

CLOVERS, ETC.

The average purity and germination percentages of the main clovers, &c., are shown in Table 6.

White Clover.—This was of the usual high standard of quality. Dodder occurred in 14 per cent. of the samples examined, compared with 5 per cent. in 1923. Dodder was noted in a fair number of the samples submitted for germination only, but as no regular examination is made of these no record is kept. The annual report of the Seed-testing Station for England and Wales for 1923 shows New Zealand white clover, when compared with that of other countries, at the top of the list for purity and germination. This statement is offset by the fact that half of the samples received by the Station in question contained dodder, usually in small amounts. The report further remarks that "this could easily be removed by suitable screening." It is doubtful whether any country pays more attention to seed-cleaning than does

New Zealand, but when dodder is in the seed crops no amount of screening will eliminate every seed of it from white clover. Crop inspection, or perhaps the use of the new electro-magnetic process of cleaning, would be a better proposition.

Table 6.—Average Percentage Purity and Germination of the Main Clovers, &c.

Seed.	Average Percentage of Impurities.	Percentage of Germination.			Percentage of Samples germinating between						Percentage of Hard Seeds.
		Highest.	Average.	Lowest.	0–50.	51–60.	61–70.	71–80.	81–90.	91–100.	
White clover ..	3·5	99	87	10	4	1	1	6	43	47	12·5
Alsike ..	2·0	98	86	13	4	1	3	10	26	56	4·4
Cow-grass ..	0·6	100	91	15	2	1	2	2	21	72	4·6
Lucerne ..	0·4	100	89	61	0	0	2	15	28	56	7·9
English trefoil	0·1	97	74	23	19	11	11	11	0	49	4·0
Crimson clover	1·3	100	93	41	3	0	64	0	10	80	0·0
Lotus major ..	11·3	99	76	33	12	6	8	22	34	18	13·2

Alsike.—All imported seed was of good quality. Only two samples contained Californian thistle.

Cow-grass and Red Clover.—These were of good quality, and practically all samples were New Zealand seed. In the English report referred to above, New Zealand red clover (cow-grass) is shown in comparison with that of five other countries. Like our white clover, it leads in purity and germination, but is third on the list with 25 per cent. of the samples containing dodder. As regards samples examined at this Station, only 5 per cent. contained dodder. Nearly eighty species of impurities were noted in cow-grass and red clover, most of them appearing in imported seed.

Lucerne.—All examined was high-grade seed. None of the samples contained dodder.

Crimson Clover.—With the exception of a few obviously very old samples, all were of high quality.

Lotus Major.—This was of fair average quality generally. Some of the imported seed was very dirty, discoloured, and high in dodder content. Northern (New Zealand) samples all contained Lotus hispidus, in quantities varying from 1 to 90 per cent. Dodder was also present in a number of these. Southern lotus major was of very high quality, although some of the samples contained ragwort.

Other Clovers, &c.—The average germination of the less common of these was as follows:—

	Germination Percentage.	Hard Seeds Percentage.
Strawberry-clover	.. 86·0	21·0
Subterranean clover	.. 70·3	22·0
Suckling-clover	.. 62·6	13·0
Lotus corniculatus	.. 56·5	10·0
Lotus hispidus	.. 54·3	26·0

ROOTS AND CRUCIFEROUS FORAGES.

The next table gives all the necessary information for this class, there being little to comment upon.

Table 7.—Average Percentage Purity and Germination of the Main Roots and Cruciferous Forages.

Seed.	Percentage of Impurities.	Percentage of Germination.			Percentage of Samples germinating between					
		Highest.	Average.	Lowest.	0–50.	51–60.	61–70.	71–80.	81–90.	91–100.
Turnips ..	0·1	100	90	31	2	3	4	8	23	61
Swedes ..	0·1	100	86	33	2	6	7	12	27	46
Rape ..	0·1	100	90	46	1	0	4	8	34	52
Kale ..	0·1	100	80	30	10	3	10	13	28	36
Chou moellier	0·1	99	85	49	3	6	6	12	27	50
					0–50.	51–100.	101–150.	151–200.	201–250.	251–300.
Mangolds ..	0·1	272	147	46	0	10	42	41	3	1

CEREALS AND MISCELLANEOUS FORAGES.

The average germination percentages of these seeds were as follows: Wheat, 88·0; oats, 85·3; barley, 74·8; rye-corn, 74·5; maize, 87·5; Japanese millet, 88·9.

PEAS, BEANS, TARES, ETC.

Average germinations under this class were as follows: Peas, 92·3; beans, 83·9; tares, 86·5; vetches, 95·0; blue lupins, 65·0.

VEGETABLES.

The average germination percentages and number of samples of the main vegetable seeds dealt with are shown in the following list:—

Seed.	Number of Samples.	Average Germination.	Seed.	Number of Samples.	Average Germination.
Broccoli ..	22	84·5	Marrow ..	18	84·3
Cabbage ..	35	79·5	Melon ..	36	86·7
Celery ..	8	55·0	Onion ..	39	60·0
Cauliflower ..	21	71·2	Parsnip ..	14	57·8
Carrot ..	82	65·6	Pumpkin ..	14	76·0
Cucumber ..	13	88·4	Radish ..	19	84·2
Leek ..	12	51·8	Spinach ..	8	42·6
Lettuce ..	13	83·0	Tomato ..	12	96·5

For purposes of comparison, those interested are referred to the Seed Station report for 1923, which was published in the *Journal* for June, 1924.

Acknowledgment is made of the careful computation of the figures in this record by Mr. W. J. Cooch, of the Seed Station staff.

VARIATIONS IN THE PERCENTAGE OF BUTTER-FAT IN MILK.

A STUDY BASED ON NEW ZEALAND C.O.R. DATA.

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IV. YEARLY VARIATIONS.

YEARLY variations in test are those which occur in the average tests for different lactation periods. The average lactational or annual test is obtained by dividing 100 times the total of the butterfat by the total of the milk produced during one lactation period. For the purposes of certificate-of-record testing a lactation period is limited to 365 days.

It is not an easy matter for dairymen to ascertain what variations there are in the tests of cows from year to year, and to what factors they are due. A cow is rarely tested each year, and, besides, the number of records available from the regular testing of one herd is hardly adequate on which to base any deductions. However, when one has large numbers of records to investigate, the nature of the variations and the causing factors are more readily apparent. Owing to the smallness of yearly test variations, considerable difficulty is experienced, even with fairly large numbers of records, in discovering the nature and assigning the causes of the many variations. A good clue to their discovery is afforded by the results of the study of monthly test variations, because of the obvious connection between the two. Hence we have here to consider the same set of factors as set out in the preceding article of this series.

YEARLY VARIATIONS DUE TO BREED.

This question was treated to some length in the first article of this series—published in the *Journal* for September, 1924—to which readers are referred.

YEARLY VARIATIONS DUE TO TIME OF YEAR OF CALVING.

The average annual tests of the four chief breeds have been tabulated according to the season of the year in which the cows commenced test, and are given in Table 15. From a study of this table it is apparent that the figures for spring and autumn and summer and winter agree quite closely. For this reason they have been grouped as shown in the two right-hand columns of the table. With the exception of the Jerseys, the average tests indicate that cows commencing in the summer or winter months test higher than do those commencing in the spring or autumn.

The annual tests for each month of commencement are given in Table 16. Owing to the blanks in the Jersey and Ayrshire figures for April and May, no average figures have been supplied or these months. Furthermore, the respective numbers of records for the months of December to June (both inclusive) are rather small, and for this reason no great weight is attachable to the averages obtained from them. It is found that the averages for July, August, and September are slightly higher than the average of the four breeds for

Table 15.—Variation in Annual Tests of Cows of the Chief Breeds commencing during Different Periods of the Year.

Breed.	Spring.		Summer.		Autumn.		Winter.		Spring and Autumn.		Summer and Winter.	
	Average Annual Test.	Number of Records.	Average Annual Test.	Number of Records.	Average Annual Test.	Number of Records.	Average Annual Test.	Number of Records.	Average Annual Test.	Number of Records.	Average Annual Test.	Number of Records.
Friesians	3·54	615	3·56	255	3·55	57	3·56	115	3·54	672	3·56	370
Milking Shorthorns ..	3·98	218	4·09	20	3·96	5	4·07	20	3·98	223	4·08	40
Ayrshires	4·12	75	4·14	27	3·74	3	4·18	8	4·11	78	4·15	35
Jerseys	5·69	134	5·50	18	5·79	4	5·56	7	5·69	138	5·52	25

Table 16.—Variation in Annual Tests of Cows of the Chief Breeds commencing during Different Months of the Year.

Breed.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	All Months.
Friesians	3·57	3·56	3·51	3·58	3·51	3·55	3·59	3·46	3·58	3·48	3·68	3·53	3·55
Milking Shorthorns	3·99	3·97	3·98	3·96	4·12	4·86	3·65	4·49	3·53	4·37	3·79	4·06	3·99
Ayrshires	4·14	4·19	4·03	4·06	4·49	3·98	3·42	3·90	..	4·47	3·96	4·11	4·12
Jerseys	5·65	5·72	5·68	5·50	5·43	5·67	5·83	5·64	..	..	4·99	5·80	5·66
Mean tests of four breeds..	4·34	4·36	4·30	4·28	4·39	4·52	4·12	4·37	..	..	4·11	4·38	4·33

Table 17.—Variation in Tests of the Principal Breeds for Different Months of the Year.

(The monthly tests are computed irrespective of the time of commencement of the lactation period.)

Breed.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	All Months.*
Friesians	3·82	3·63	3·48	3·46	3·45	3·47	3·50	3·60	3·70	3·79	3·88	3·90	3·63
Milking Shorthorns	4·36	3·87	3·73	3·79	3·87	3·93	4·03	4·19	4·35	4·43	4·61	4·62	4·13
Ayrshires	4·43	4·18	3·93	4·00	4·05	4·12	4·10	4·17	4·33	4·42	4·53	4·53	4·23
Red Polls	5·08	4·43	4·07	4·17	4·17	4·20	4·24	4·46	4·60	4·85	5·08	5·10	4·54
Jerseys	5·86	5·15	5·15	5·37	5·54	5·66	5·71	5·94	6·38	6·53	6·59	6·49	5·85
Mean	4·71	4·25	4·07	4·16	4·22	4·28	4·32	4·47	4·67	4·80	4·94	4·93	4·48

* The tests vary from those for a similar column in Table 16 for the reason that these tests are calculated irrespective of milk-production, while for the other table they are computed by the method outlined at the opening of this article.

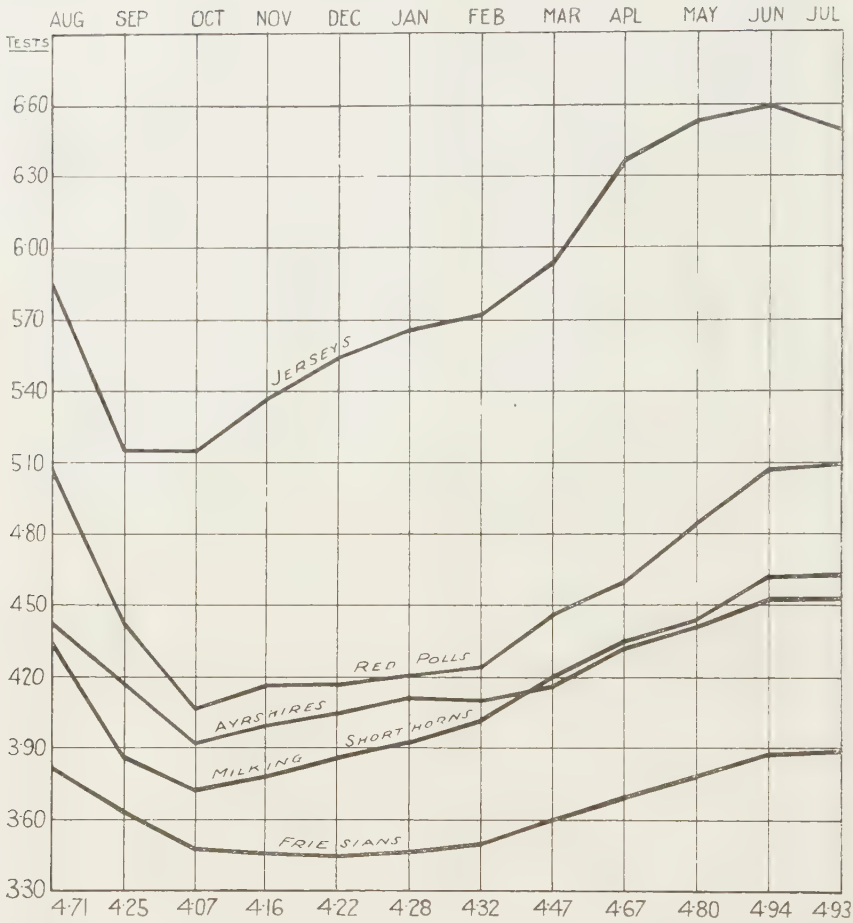
all months of commencement, which reads 4·33 per cent. The average for all breeds, grouping December, January, February, March, and June together, is 0·03 below the average for all months.

The table is rather incomplete to be sufficiently reliable, so the question may be attacked from another angle. In order to obtain an indication of the months of the year during which cows test highest, lactational tests for the chief breeds have been summated and averaged for all months of the year. In other words, this analysis gives the average test for any particular month according to the breed of cow, and irrespective of the month of commencement of test. The results are presented in Graph 11. A glance at this graph suffices to show that the variation in tests for different months is marked. The tests for June and July rank highest in each case, May and August coming next. October is the lowest in each curve with the exception of the Friesians, in which case the lowest point occurs for the month of December. September, October, and November are bound to be low, for the reason that grass feed is then at its best and most abundant. This keeps the quantity of milk-production up with the subsequent loss in test. This point is readily apparent in cases where cows are completing a lactation period in the spring (see August to December curves in Graph 7 of third article of series). The curves of the five breeds vary somewhat in conformation. However, the average figures of the five breeds given at the foot of the graph (No. 11) present the general position very clearly. All cows were not tested the full number of times, which may be either twelve or thirteen, and for this reason equal numbers are not represented for each month. In order to ascertain how this affected the results a number of Friesian records were selected, for each of which the annual test was approximately 3·55 per cent. (this being the average annual test for all Friesians), and for each there were twelve monthly tests. Six were selected for each month of commencement, and thus seventy-two records altogether are presented.

The result is given in Graph 12. The curve for all Friesians is included for purposes of comparison. The figures at the top and bottom of the graph refer respectively to the curves for the "selected Friesians" and for "all Friesians." The selected Friesians give a curve considerably flattened out compared with that for all Friesians. The general trend, however, remains practically the same, and the curve lends itself to the same division which is characteristic of the other.

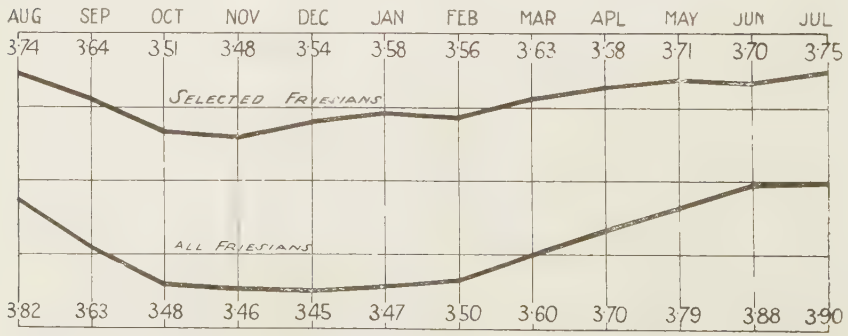
The grouping of the results into periods is given in Table 18. For the selected Friesians the range of variation over the three groups has been considerably reduced from that for all Friesians, the reduction amounting to 100 per cent. It is very probable that equal reductions in the range of variation would be found in the results of standard data for the other breeds. At the same time it is expected that the trend of the curves as shown in Graph 11 would be confirmed. By adopting for each breed in Graph 11 similar groupings to those of Table 18, one is better able to understand the results given in Tables 15 and 16.

The groupings are not necessarily the same for each breed, and to facilitate this the figures for Graph 11 are given in Table 17. Flush



GRAPH 11. VARIATION IN TESTS OF THE PRINCIPAL BREEDS FOR DIFFERENT MONTHS OF THE YEAR.

(In this and the next graph the monthly tests are computed irrespective of the time of commencement of the lactation period.)



GRAPH 12. VARIATION IN FRIESIAN TESTS FOR DIFFERENT MONTHS OF THE YEAR. STANDARD VERSUS COMPLETE DATA.

of milk-production varies somewhat with the breed, the general rule being that the heavier the breed the later the time. Thus Jersey cows, because they are lighter, reach flush of milk-production after calving earlier than cows of the other principal dairy breeds. Furthermore, the lactational tests for Jerseys rise continually throughout the lactation period, this, as pointed out in the third article, not being the case for the other breeds (see Graph 4, page 78, *Journal*, February, 1925). For the other breeds the test decreases for a while and then rises steadily to the end. Lactational-test curves vary for different periods of the year of commencement, and so does flush of milk-production. As a rule flush of milk-production is fairly well maintained for cows of good dairy qualities until about the sixth month. If these points are considered in conjunction with Table 17 one now sees the reason for the apparent anomalous result for the Jerseys in Table 15.

To sum up, therefore, May, June, July, and August are the highest-testing months. Cows commencing so that they reach the flush of their milk-production during the above-mentioned period will have higher annual tests, and will produce more butterfat, than for any other period of commencement. This conclusion agrees with that of an investigation made by the United States Dairy Division (see U.S.A. Bulletin 1071), in which it was found that autumn-freshened cows produced most butterfat, next in order being winter calvers, and spring and summer calvers lowest with equal amounts. In all 10,870 records were studied.

Table 18.—Friesian Monthly Tests for Different Periods of the Year, irrespective of Time of Commencement of Lactation Period: Standard versus *Complete Data.*

Periods.	All Friesians.		Selected Friesians.	
	Average Test.	Percentage Total Range of Variation over Three Periods.	Average Test.	Percentage Total Range of Variation over Three Periods.
May, June, July, August ..	3·85	..	3·72	..
March, April, September ..	3·64	10·5	3·65	5·2
October, November, December, January, February	3·47	..	3·53	..
Average monthly test ..	3·63	..	3·63	..

NOTE.—For individual monthly tests see Graph 12.

YEARLY VARIATIONS DUE TO LENGTH OF PERIOD OF GESTATION DURING TEST.

In order to ascertain the effect of the length of the period of gestation on the annual test a random selection of available data has been taken and tabulated according to the varying periods between commencement and effective service during test. The results of this analysis are given in Table 19. Where cows are empty for less than eighty-three days during test they will calve within 365 days following calving at commencement (the gestation period is taken as 282 days). Such records are represented by the first groups given in the table.

The other groups taken in order are for cows calving subsequent to test during the thirteenth, fourteenth, and fifteenth months respectively. The variations in test for this table are of a peculiar nature, and require further investigation. However, it appears clear that cows test highest for a period of about thirteen and a half months between consecutive calvings. If the period is more than this the annual test is lowered somewhat. The two- and four-year-old Friesians do not agree very well in variations for similar groups, but by combining the data the average tests for the groups reading downwards in the table are then 3·50, 3·46, 3·52, and 3·51, and thus agree closely with the Jersey results.

Table 19.—Variations in Annual Tests due to Length of Period of Gestation during Test.

Number of Days empty after Commencement of Test, both Limits inclusive.	Two-year-old Jerseys for Seasons 1914–15 and 1915–16.		Two-year-old Friesians for Seasons 1914–15 and 1915–16.		12,000 lb., 13,000 lb., and 14,000 lb. Milk-records of the Four-year-old Friesians for all Seasons.	
	Average Annual Test.	Number of Records.	Average Annual Test.	Number of Records.	Average Annual Test.	Number of Records.
Up to 85 ..	5·54	26	3·58	11	3·43	13
86–115	5·52	33	3·46	12	3·47	10
116–145	6·01	25	3·56	19	3·49	21
146–183	5·47	11	3·59	8	3·46	11
Average tests for all groups	5·65	95	3·55	50	3·46	55

Table 20.—Variation in Annual Tests due to Length of Lactation Period: Jersey Data.

Length of Lactation Period in Days.	Average Annual Test.	Number of Records.
Up to 325	5·59	24
326–355	5·52	15
356–365	5·47	20

By selecting Jersey two-year-olds data from the previous tabulation for which shorter periods than 116 days occurred between calving at commencement and effective service during test, and grouping these records according to the varying number of days in milk, test variations were obtained as shown in Table 20. The results show that the shorter the lactation period the higher is the annual test.* The twenty records for the limits 356–365 days as given in this table were grouped into two, according as the "fallow" period was more or less than ninety-five days. The average annual test for the shorter period was 5·52, and that for the longer period 5·45. Thus after eliminating the factor of length of lactation period it is still found that the factor of length of pregnancy causes variations in the annual test.

* This is not necessarily true in cases where the lactation period is terminated before a cow is actually dry, as is the case for some C.O.R. records. Also in many C.O.R. records for which cows have milked the full allowed lactation period (365 days) the cows are far from being dry.

Referring back to Table 19, it is now seen that for the group "up to 85 days" two factors are operating which tend to raise the test, whereas for the remaining groups there is only one. This perhaps explains the dip in the annual tests occurring between the first and third groups. The intermediate tests for the two-year-old Jerseys from 116 to 183 days for limits of ten days only are as follows: 6·09, 6·06, 5·68, 5·67, 5·45, 5·12. Therefore it can be concluded that, with the exception of the high point indicated in the third group of Table 19, the shorter the fallow period during test the higher is the annual test, and the longer that period the lower the test, the latter being true up to a period of about seven and a half months, when no further lowering of tests takes place. This statement is well borne out in Graph 9, page 86, and text, page 87, *Journal*, February last.

YEARLY VARIATIONS DUE TO NATURE OF SEASON.

Variations in annual test due to the nature of the season, though very small, are nevertheless quite interesting. In Table 21 the averages for the Friesian tests, amount of rainfall, and number of rainy days are given season by season. Plus and minus variations are supplied in the adjoining columns for each of the three mentioned items, and for purposes of comparison the mean figures for the eleven seasons are given at the foot of the table. The average tests are estimated equivalent to maturity—that is, for each season the average milk and butterfat figures for the various classes according to age have been raised to what they would be if the records had been made at maturity, and the test obtained from this result. By this means the factor of age is eliminated from the results.

Correlation between amount of rainfall and yearly test variations seems difficult at first, as the table shows tests for six seasons varying inversely with the rainfall, while for the five remaining the relation is direct. However, when both amount of rainfall and number of rainy days are considered with the test variations, one is able to elucidate some of the difficulties. The variations in the first and third right-hand columns agree in sign for each season with but three exceptions—1912–13, 1916–17, and 1919–20. For 1912–13 the South Island was above and the North Island below the mean rainfall, while for season 1916–17 the contrary was the case. In 1919–20, however, the amount of rainfall for each Island was above and the number of rainy days below the mean for all seasons. In the light of this information it is not unreasonable to accept 1912–13 as conforming very closely to a season of average rainfall. The position is strengthened also in regard to season 1916–17. The number of rainy days for season 1919–20 is so much below the average that this season can be safely classed as a poor one for rainfall in general.

Now that the positions in regard to these seasons have been somewhat reconciled, there are left only three other seasons (marked with an asterisk) where the test variations vary directly with the rainfall. When it is borne in mind that the percentage of cows tested in each Island varies from season to season, that the testing season somewhat overlaps twelve months, that the amount of testing is not represented equally or in all districts where rainfall-recording stations

are situated, and that the climate varies considerably throughout New Zealand, it is not at all surprising that a few of the results do not conform to the general rule. There appears, however, to be sufficient evidence to conclude that the small fluctuations which occur in the test from season to season are due to the rainfall and vary inversely with it, and that, with regard to rainfall, both amount of rainfall and number of rainy days must be given due consideration.

Table 21.—Variation in Annual Tests due to Nature of Season experienced. Total Friesian Data.

Season.	Average Mature Equivalent Test.	Variations from Mean Mature Equivalent Test.	Average Seasonal Rainfall for New Zealand.	Variations from Mean Seasonal Rainfall for New Zealand.	Average Number of Rainy Days per Season for New Zealand.	Variations from Mean Number of Rainy Days per Season for New Zealand.
			Inches.	Inches.		
1912–13 ..	3·52	0·00	42·35	— 1·20	155·0	+ 4·9
1913–14 ..	3·51	—0·01	45·09	+ 1·54	165·2	+15·1
1914–15 ..	3·56	+0·04	32·92	—10·63	133·2	—16·9
1915–16* ..	3·49	—0·03	41·08	— 2·47	142·9	— 7·2
1916–17 ..	3·51	—0·01	48·54	+ 4·99	149·5	— 0·6
1917–18* ..	3·58	+0·06	49·02	+ 5·47	161·4	+11·3
1918–19* ..	3·51	—0·01	39·52	— 4·03	144·9	— 5·2
1919–20 ..	3·59	+0·07	45·39	+ 1·84	140·6	— 9·5
1920–21 ..	3·55	+0·03	38·75	— 4·80	139·5	—10·6
1921–22 ..	3·45	—0·07	46·76	+ 3·21	154·2	+ 4·1
1922–23 ..	3·48	—0·04	49·67	+ 6·12	164·6	+14·5
Mean ..	3·52	±0·03	43·55	± 4·21	150·1	± 9·1

* Exceptions.

YEARLY VARIATIONS DUE TO CONDITION OF COW, FEEDING, ETC.

As mentioned in the two preceding articles, there are no data available from certificate-of-record testing with which to investigate for the effect of variations due to condition, feeding, &c., of the cow. It is considered that cows of approved dairy type commencing in good condition, and so maintained during test, would test higher than cows which commenced in poor condition or were poorly fed during the lactation period.

YEARLY VARIATIONS DUE TO AGE.

As the age advances after first calving, the annual test gradually decreases by small amounts for approximately ten lactation periods. About this stage it commences to rise slightly. Tests for the Jerseys and Friesians according to age are set out in Table 22. Figures for the Ayrshires and Milking Shorthorns are not included, for the reason that they were rather irregular, due to the numbers of records representing many of the ages being very few. The percentage total range of variation for the four breeds according to the grouping in the table is about 6 per cent. only, the respective percentages for the Jerseys and Friesians reading 5·8 and 3·7.

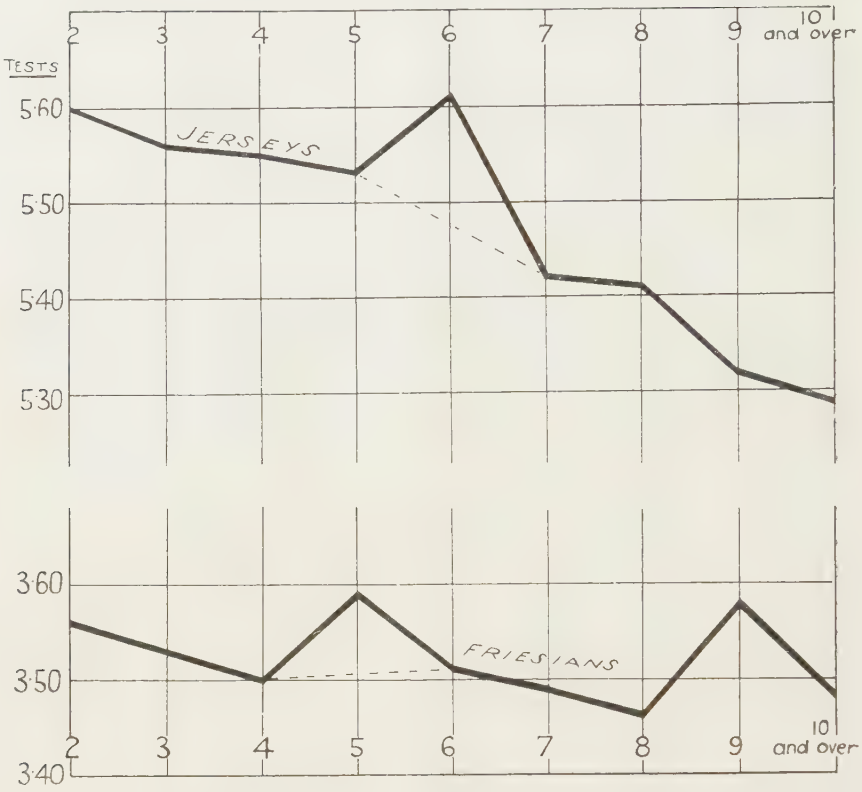
The trend of variation in test for the factor of age is more clearly seen in Graph 13, which represents the results given in Table 22. The most striking feature in these two curves occurs at the age of five years for the Friesians and at six years for the Jerseys. At these points the practically uniform trend of the curves is considerably upset. These points seem quite unaccountable, but if they are omitted and the blanks bridged by the dotted lines shown in the graph it is found that the trend of the curves is quite uniform.

The abnormal point varies slightly with the breed, the ages at which it occurs for the chief New Zealand breeds being as follows: Jersey, six years; Friesian, five years; Ayrshire and Milking Shorthorn, seven years. These abnormal points are all high ones, but when United States and New Zealand Jersey tests are compared for the factor of age, as given in Table 23, quite an astonishing position is revealed. The abnormal point for the American Jerseys occurs, as in the case of the New Zealand Jerseys, at the age of six years, but for some unknown reason it is abnormally low. In the right-hand column of the table the mean of the two results is given. The abnormal point has been absorbed, showing that in the one case it was as high as it was low in the other. Unfortunately, the writer has no American data except for the Jersey breed. It would be interesting to see if the abnormal points for the other breeds of the United States were all low ones. One important point, however, is that in all cases the abnormal point is practically coincident with maximum butterfat-production, occurring if anything just before this stage. The ages of maximum production and maturity would be expected to coincide, and thus it appears that the abnormal-test point depends on the reaching of maturity, and is due to a physiological change in the cow at this stage. The connection between the action and changes of metabolic activity and the quality of milk and its variations is not very well understood, but there seems good reason to believe that this factor is quite an important one.

Table 22.—Variations in Annual Tests due to Age.

Age.	Jerseys.		Friesians.	
	Average Test.	Number of Records.	Average Test.	Number of Records.
Years.				
Two	5·60	1,154	3·56	413
Three ..	5·56	407	3·53	213
Four	5·55	250	3·50	137
Five	5·53	178	3·59*	79
Six	5·61*	152	3·51	66
Seven ..	5·42	99	3·49	55
Eight.. ..	5·41	54	3·46	26
Nine	5·32	51	3·58	12
Ten and over ..	5·29	46	3·48	41
Average tests for all ages	5·55	2,391	3·54	1,042

* Abnormal points.



GRAPH 13. VARIATION IN ANNUAL TESTS DUE TO AGE.

(The test for the nine-year-old Friesians is anomalous, and is due no doubt to the paucity of records for this group. See Table 22.)

Table 23.—Variations in Annual Test due to Age: United States and New Zealand Jersey Tests compared.

Age.	Average Tests of U.S.A. Jerseys.	Average Tests of N.Z. Jerseys.	Mean of the Two.
Yearlings	5·43	5·60	5·52
Two years	5·45		
Three years	5·41	5·56	5·49
Four years	5·41	5·55	5·48
Five years	5·30	5·53	5·42
Six years	5·21*	5·61*	5·41
Seven years	5·28	5·42	5·35
Eight years	5·25	5·41	5·33
Nine years	5·23	5·32	5·28
Ten years	5·22	5·28	5·25
Eleven years ..	5·17	5·39	5·28

* Abnormal points.

YEARLY VARIATIONS DUE TO QUANTITY IN MILK-PRODUCTION.

This phase of yearly variations was treated in the first article of this series (September, 1924), wherein it was stated that quantity and quality of milk-production were believed to be separately inheritable, but that the two had a limited interdependence and varied inversely, this being most noticeable when one factor varied considerably in either extreme.

CONCLUSIONS.

Summing up the general position in regard to variations in yearly tests, it is found that in all cases, except for the factor of breed, the variations are of small magnitude. Furthermore, they depend almost entirely on monthly test variations, and if the results of this article are studied in conjunction with those of the previous one a better grip of the subject should be obtained.

NOTES.

Period of Data.—The Jersey data used in the compilation of Tables 15, 16, and 17, and Graph 11, are for season 1918–19 only. In all other cases, unless otherwise stated, the data used for the various breeds comprise all first-class records from the commencement of C.O.R. testing (1913) up to 31st December, 1923.

Corrections.—In the third article of this series—*Journal*, February, 1925—(1) the footnote marked † on page 77 should read, "The equation for this line is: Number of days in the dip of the lactational-test curve of a particular breed = 722–(163 times the average test of that breed)"; (2) under the heading of "Lactational Variations due to Nature of Season," 1915–16 should be deleted from the list of good seasons.

(Series to be concluded.)

SOME SOUTH AFRICAN AGRICULTURAL NOTES.

M. H. DIXON, A.C.P., Technical College, Napier.

TEFF-GRASS.

On a recent visit to South Africa the writer found that the Abyssinian grass named teff (*Eragrostis Abyssinicus*) is steadily gaining favour as a secondary crop. Many farmers in the Transvaal declared that they intended it to become their main fodder in the future, finding it less wasteful than lucerne and just as well liked by their stock. An analysis of teff recently published by the South African Department of Agriculture compared very favourably with that of lucerne.

After obtaining a fine tilth, from 4 lb. to 5 lb. only of seed per acre is sown, and, if no rain occurs in the interval between harrowing and sowing, the seed is not harrowed in. If, on the other hand, the land has had rain during this interval, the ground is reharrowed with a light harrow or similar cultivator after the seed has been sown. Growth at first is very slow, but after four weeks' favourable weather the field begins to show green, and from this stage onwards the growth is very rapid, and the teff is usually ready to cut four months from time of germination. Given favourable weather conditions, a profitable second cut can be made in two months after the first one. A good crop yields from 2 to 2½ tons per acre, and the market price of good quality teff hay runs from £4 to £4 10s. per ton.

Teff hay can be carried long distances over rough roads or paddocks without much loss, as its constituent parts are not in the least brittle. The South African farmer finds that lucerne hay, even when in bales, loses a good deal of the leaf-growth during transit from farm to town, or from one part to another on the larger farms. It is also found that there is a greater loss of the more nutritive parts of lucerne hay after it is distributed to the stock than is the case with teff.

Teff has a great popularity for cleaning dirty lands, and I was frequently told that when allowed to germinate at the same time as prevalent weeds, such as amaranthus (pig-weed or Prince of Wales feathers), which is as troublesome in the Transvaal as in some parts of New Zealand, it invariably smothers the weeds in addition to giving a profitable yield of hay.

[NOTE.—A test plot is being sown in teff-grass by Mr. Dixon at Napier this autumn, and he intends making another sowing in the spring. Certain previous trials under New Zealand conditions have not been altogether favourable to teff for this country, and caution is suggested until further local experience is acquired.—EDITOR.]

THE MAIZE INDUSTRY.

A feeling of greater security is being given to the South African maize-growers by the erection in several towns of concrete grain-elevators, which consist of a number of storage bins—usually about twenty-four—each having a capacity of 40 tons, and half-a-dozen storage cylinders having about three times this capacity. In January of this year a conference was held at Johannesburg, attended by representatives of the South African Agricultural Union, the South African Maize-growers' Association, and the Central Agricultural Co-operative Society, to consider the organization of the maize industry on co-operative lines more or less similar to those of the Alberta Wheat Producers' Co-operative Association in Canada.

AGRICULTURAL ECONOMICS.

The work of the South African Department of Agriculture has mainly been in the direction of combating plant and animal diseases, and in improving and promoting the increase of plant and animal products. This year, however, has seen the creation of the Division of Agricultural Economics and Markets, of which Dr. F. Geldenhuys, of Bloemfontein, has been appointed chief. The work of this division will include the investigation of all kinds of economic questions associated with farming, marketing of crops, co-operation, farm-management, &c. Such questions as farm credits, tenant systems, and the social welfare of the farming population will be investigated.

VETERINARY RESEARCH AND TRAINING.

The numerous diseases prevalent among horses, mules, cattle, goats, and sheep in South Africa have caused the establishment of research institutions for the investigation of these diseases. The largest of these was visited- Onderstepoort Biochemical Research College, near Pretoria, which has four departments, one being a university school for students who have previously spent two years in the study of English, mathematics, and general subjects at some other university college, and have transferred to Onderstepoort to specialize as veteri-

nary surgeons. The course extends over three years, and there are thirty students this year—ten for each year's course. The other departments are respectively for original research work, the preparation, testing, and distribution of vaccines (for which purpose many kinds of animals are kept on the place), and the administration department. The vaccines for anthrax, redwater, gall-sickness, bluetongue, and black-quarter (blackleg) were shown, also a powder which has been proved to be a very effective remedy for wire-worms in sheep. After seeing many features of the microscopic work carried out in the different laboratories and also numbers of the animals on which new vaccines were being tested, I was not surprised when told by Dr. E. V. Cowdray, of the Rockefeller Research Institute, New York, who had been engaged in research work for six months at Onderstepoort, that he did not think there was any college, even in America, which was doing greater service for the farming community of the country. Large quantities of the vaccines and powders are despatched every week for distribution to farmers at very small cost, each remedy being accompanied by printed matter giving very complete instructions and advice as to treatment.

MANURIAL EXPERIMENTS.

A visit to the Government Experimental Farm and School of Agriculture in the Transvaal revealed that institution to be somewhat like a combination of our Ruakura Farm of Instruction and Lincoln College. Mr. Thomas D. Hall, of the Experimental Division, showed me results of fertilizer experiments on maize, teff, and potatoes. The general conclusions drawn from these were that, although light applications of some nitrogenous fertilizer are occasionally beneficial in the early stages of growth, the phosphatic constituent of any mixture of fertilizers is the only one that pays with certainty, and that in almost every experiment the application of superphosphate, 300 lb. to the acre, without any other fertilizer, had produced the best results. The success of this fertilizer was especially noticeable in the potato crops, the size and cooking-qualities of the potatoes from the plot receiving superphosphate at the rate mentioned being the best. Moreover, the value of superphosphate was apparent on crops of maize and clovers not treated with fertilizers that year, but where other crops on the same ground had received an application in the preceding season. Indeed, growth on those plots where superphosphate had been applied for the previous crop was better than on any of the others.

CLOSE SETTLEMENT.

Close settlement is being developed in the Transvaal by the sale of Government sections of from 50 to 80 acres situated along the bank of a river, each owner of a section having grazing-rights on the "common land," situated adjacent to the sections at a farther distance from the stream. A visit was paid to one of these settlements near the Mooi River, and also to a similar settlement in the Potchefstroom district, provided with water by means of irrigation canals leading away from the Klipdrift Dam, built by the Government at a cost of £80,000, each canal being five miles long. There are eighty families located at this particular settlement.

SEASONAL NOTES.

THE FARM.

CULTURAL OPERATIONS.

PLANS should be made at this period for next season's cropping-operations, and land required for spring sowing turned over. Where old pastures are to be broken up, skim ploughing in the autumn or early winter, followed by disking, especially on the heavier soils, as a preparation for the deeper spring ploughing, is a good insurance against dry summer conditions, besides allowing the natural elements — frost, air, and sunshine — to ameliorate the soil and make fresh plant-food available.

The relatively dry autumn experienced in several districts this season has had the effect of reducing to a great extent the usual autumn growth of pastures. This has there caused an earlier and more extensive feeding of roots and other forages, which in many cases may involve a shortage in early spring. A June sowing of Algerian oats, combined (on the heavier soils) with winter vetches, will help to fill any such deficiency.

AUXILIARY FEEDING OF DAIRY STOCK.

Wherever it can be managed great saving results from pulling and feeding out roots in clean paddocks, rather than turning the stock on to the crop, and a much smaller quantity of roots is required. Experiments go to prove that 60 lb. of roots per day fed to a cow in conjunction with good hay gives very much better results than where the cow is allowed to eat as much as she can. In the latter case the animal may eat 1 cwt. or more, and her system is not able to deal with the material satisfactorily. The ideal ration is a medium quantity of good material rather than large quantities which the animal cannot digest. Great care should also be taken to see that stock eating roots have a liberal supply of good hay or a run-off on pasture with plenty of roughage.

The present is a good period for pulling the mangold crop, so as to give the roots ample time to mature before being fed. Such time should be at least one month, but two is much better. A mangold is not in proper condition to feed out in quantity until soft enough to allow a pocket-knife to be stuck into it easily and drawn out again without lifting the root. A great many may have to be fed before reaching this condition, but full maturity is the condition to aim at. When starting cows on mangolds they should be fed lightly for a few days, commencing with 15 lb. to 20 lb. per day and increasing at the end of a week to 40 lb. or 50 lb., which should be the maximum for a day. In the milder localities the roots may be pulled and left in the field to ripen, but when there is danger of heavy frosts or the land is required for further cropping it is best to cart them off and store in a dry, warm, situation, according to the methods described last month.

Carrot crops will still be making some growth, but may now be fed at any time. These roots are best pulled and fed straight out from the field.

Where ensilage is available, cows that have not been used to this fodder should get a small quantity—say, 5 lb. to 10 lb. per head per day—for the first few days, increasing up to a maximum of 40 lb. per day. Silage should be fed fresh each day and, as far as possible, straight from the stack to the stock. If exposed to the weather, deterioration is fairly rapid.

The value of concentrates for dairy cows—especially where winter milking is practised—is being increasingly recognized as our dairying becomes more intensified.

PASTURE-MANAGEMENT.

The formation and maintenance of a pasture does not end with the selection of the seed-mixture and annual top-dressing. Subdivision, spelling, stocking, and cultivation have a far-reaching effect on the quantity and quality of herbage produced. Under the head of cultivation can be included mowing, rolling, harrowing, disking, &c. The mower is valuable for disposing of any rank growth neglected by the stock and allowing fresh growth to come away, particularly in fields grazed by cattle. Except for hay, it is a mistake ever to allow the grass to stand more than 5 in. or 6 in. high. Rolling is an operation seldom carried out, but does much good on light land, more particularly where a severe winter is experienced. It strengthens any grasses or clovers that have been lifted by frost or loosened by stock. Rolling, however, should never be done during frost or when the land is abnormally wet.

Harrowing is one of the cheapest and most profitable operations on the farm, and there are few better ways of utilizing days when other work cannot be undertaken. Stock manure is a fine top-dressing, and its distribution by harrowing is a factor in the maintenance of a good turf. Chain-harrows will do this work well, but when the tripods are employed further benefits are derived from the cultivation of the turf, whereby moss and dead matter are removed and the grass-roots stimulated. In some cases, such as that of a sod-bound turf, a good disking, followed by rolling, will put new vigour into the pasture.

The subject of top-dressing with artificial fertilizers was dealt with at some length in last month's notes, but a reminder may be given that June is one of the best months for this operation. A few farmers appear to be afraid to apply phosphates in the winter, having an idea that they will disappear in the drainage-water before spring. There is no reason for such fears; it has been clearly proved that leaching of phosphates need not be seriously considered.

GENERAL.

Any necessary repairs to cow-sheds, yards, &c., should be pushed on, especially where concrete floors are being put down. If these floors are allowed to harden properly before being used the uneven pot-hole surface so frequently seen is obviated. Bog-holes and bad crossings should have attention, as these frequently cause considerable loss in the spring when stock are weak. Arrears in drainage-work should also be attended to. Where the mouths of drains are consistently kept open full benefit of the drainage-system will be secured.

—*Fields Division.*

THE ORCHARD.

CLEANING-UP.

THE picking season now being over, the orchardist will be able to devote his attention to other seasonable work, and also to give the orchard, packing-shed, and surroundings a general clean-up. An important preliminary is the cleaning-up of all fruit unfit for sale. It is bad practice to allow half-decayed and rotten fruit to lie about either under the trees or around the packing-shed. This class of fruit is usually infected, or is liable to breed fungoid diseases which become harmful to both trees and fruit.

PRUNING.

This work will commence in real earnest in June. All stone-fruits will have lost their leaves, and they should be the first to receive attention. Many different methods are adopted in pruning stone-fruits —some good, some indifferent. It is not possible to lay down any rule that will be applicable to all parts of the Dominion, but the foundation principles advocated by the Department from time to time still hold good. It is in detail that several different methods can be followed with satisfactory results. Some of the leading growers in America are carrying out very little pruning on stone-fruits, but it is quite an easy matter to go from one extreme to the other. While not being an advocate of non-pruning in this Dominion, I consider it bad practice to cut too severely. One should always be guided by local conditions, and, moreover, test several systems in order to ascertain the relative value of each.

The commonest mistake—and a very harmful one—is to prune trees hastily on a uniform method, which, however good it may be in itself, cannot but be harmful to a large proportion of the orchard. For example, the Sturmer, Delicious, and Jonathan apple-trees are of such diverse type that a one-system practice must do harm. The simplest way is to take one variety at a time, to remember its nature, and do all that is possible to correct its natural bias where such is necessary. The Delicious tree is usually very vigorous and inclined to become densely wooded, and to cut the leaders hard and stop the laterals back to young wood-buds would only intensify its habits, which are bad from a fruitgrower's point of view. On a mature tree the leaders should be pruned lightly, if at all, and the laterals well thinned out, cutting them clean back to the leader from which they originate. If it is necessary to shorten remaining laterals, care should be taken to cut to fruit-buds or small side twigs, thus stimulating as little growth as possible. This method has been found to check growth and encourage cropping. The Sturmer in most fruitgrowing districts is a type of those with just the opposite characteristics, and the pruner has usually to prune the tree, which is naturally a heavy cropper, to encourage a vigorous constitution. He has to cut the leaders harder than in the case of the Delicious, and, where laterals are inclined to fail, to cut them to young wood-buds so as to invigorate them. If the pruner studies his pip-fruit trees along these lines a great improvement will be brought about in many orchards.

MISCELLANEOUS.

When pruning, the opportunity should be taken of examining the trees carefully for disease, and any requiring special treatment can be flagged with a piece of cotton cloth carried for the purpose.

The best-cropping trees are usually well known—indeed, they are often the centre of considerable admiration. Suitable wood cut from such trees should be saved for any reworking that has to be done, carefully labelled, and heeled in damp, sandy ground in a cool place.

The preparation of land for further planting may be proceeded with; but so important is this preliminary work that if it cannot be completed satisfactorily planting should be deferred for this season.

If fruit is sound and properly stacked in a good, well-ventilated shed there should be little loss from decay, but it is always well to keep acquainted with the condition of stocks. Do not fail to market varieties at the right season. Heavy losses are incurred annually by overstoring. Do not be tempted to store cull fruit or market it either; it is not wanted, and is much better fed to stock.

—L. Paynter, Orchard Instructor, Christchurch.

CITRUS-CULTURE.

To control *Lecanium Oleæ* scale an application may now be made of either red oil, 1-40, or commercial lime-sulphur, 1-35, without fear of defoliation. Where there is doubt as to the condition of the tree being suitable to stand an application of the compound necessary, growers will have to take a certain amount of risk of defoliation, as if the spray is not applied very shortly the scales will have become sufficiently matured to withstand the spraying to a considerable extent, and a maximum kill will not be obtained.

Measures for control of brown-rot on citrus-fruits should now be put in hand. Precautions which would appear to be most important are: Firstly, to remove all bottom branches from the trees, so as to leave none that will hang any nearer than 18 in. from the ground. Secondly, to keep all matured fruits picked periodically. Thirdly, to keep the centre of the trees as open as possible, so as to allow free ventilation. Further, in cases where infection occurred last year the grower is advised to spray the soil beneath the tree, as far out as the spread of the branches, with pure bluestone, 1-15, giving a liberal dressing. It must be explained that the spores of brown-rot are motile, and travel chiefly by means of a thin film of water—infection taking place firstly from spores in the ground. By this means the source of infection through the branches sweeping on the ground and thus picking up the infection, or by heavy rains splashing the spores to the low-hanging branches, will be considerably lessened. Further, there is little doubt that the spores may travel up the trunk during very wet weather when the tree is saturated with water over a considerable period. Spraying of the trees with bordeaux, 4-4-40, at the latter part of May, as a preventive, may, of course, be resorted to, but the adoption of the method outlined will tend to get right at the source of the trouble and kill the spores themselves in the ground before maturity.

The soil is now in excellent condition generally for putting in hand the work of preparation of new citrus-orchard sites. Those growers who are intending to plant should place their orders as early as possible with reliable nurserymen.

STRAWBERRY-GROWING.

Generally, growers are well forward with the preparation of sites for the new beds. Those who have so far not made the necessary arrangements for the supply of a reliable strain of Marguerite, Duke of Edinburgh, or Melba, are recommended to make early application, as it is anticipated that there will be a heavy demand next season. The variety Captain Cook was grown last season in fair quantities, and the fruit, though not surpassing the Marguerite in quality, carried in chips equally well, and generally opened up in a showy condition. In many localities the plant does as well as the Marguerite, but complaints have been received from some growers that it lacks constitution as compared with the latter variety.

—*J. W. Collard, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

SELECTION OF BREEDING-STOCK.

THE coming month should see all the breeding-pens mated up. There is yet ample time to commence hatching operations, but it is always a wise course to have the birds mated well ahead, in order that they may be well settled down before the eggs are required for reproductive purposes. A common mistake made, especially by side-line poultry-keepers, is to use eggs for hatching purposes indiscriminately from a flock of fowls. If a good laying-strain is to be built up or maintained it is of the first importance that only the best birds in the flock shall be bred from. These should be placed in a breeding-pen by themselves. The great underlying principle in all breeding is that like produces like. Thus, if the best returns are to be secured and cull stock reduced to a minimum, nothing but ideal specimens should be bred from.

On all well-managed plants (as advised in previous notes) the proposed breeders for the coming season should have been chosen and carefully marked before the commencement of the moulting-period, for it is then and only then that the best specimens can be selected with any degree of certainty. For a bird to give a heavy egg-yield and be a long-season layer she must necessarily be a late moulter, and it is difficult or almost impossible to detect such birds if left till the whole flock has moulted. Where individual records have been kept by means of trap-nests or single pens the birds can be mated according to their productive capacity, as the individual record is the only means of knowing accurately the laying-power of a bird. This system of finding the best layer, however, is seldom adopted by other than specialist breeders. Thus if nothing is known of the laying-power of a bird she must necessarily be selected by her general appearance, and there is no better guide to this than by choosing the late moulter—providing, of course, that the bird possesses desirable breeding characters in other respects.

The eye for form is to some extent a natural gift, but with careful study and observation the average poultry-keeper will find little difficulty in selecting the most suitable birds. In the first place, it is important to have fixed types of purebred birds, or at

least of birds that are fair specimens of the breed they represent. It is true that crossbred fowls which have no special type or points indicative of purity of breed will at times give a good egg-yield. There are exceptions to every rule, but this does not disprove that a definite type should be aimed at. The chief objection to breeding from a crossbred bird is that this invariably destroys fixity of type, and opens the door to reversion and the appearance of latent undesirable characteristics.

Having purebred stock, the next consideration should be given to constitutional vigour, as, no matter how good the type or pedigree of performance possessed, desirable progeny will not be produced if there is the slightest constitutional taint in the parent stock. Especially should the male be strong in points indicating

WHITE LEGHORN, LATE MOULTER, OF GOOD BREEDING-TYPE.

Photo taken towards end of a heavy-laying season, this accounting for general shabby appearance of bird.

stamina. The head affords a good guide in this respect. Generally a bird of either sex with a short broad head, a stout well-curved beak, bright clear prominent eyes, and face free from feathers and wrinkles has a good constitution. These points should be combined with a well-developed crop (indicating heart and lung capacity), tight feathering, short shanks set wide apart, and an active, alert, businesslike appearance. The shape of the hen denotes whether she is of a heavy-producing type or a meat-maker. The qualifications to be looked for in a good breeding-hen are indicated by an oblong body, well-developed crop, deep and full abdomen of fine texture, the bird thus tapering from thighs to head and forming a wedge-shaped appearance.

Care should also be taken to breed not only from birds which possess points indicative of purity of breed, laying-capacity, and undoubted constitutional vigour, but also from those laying a good marketable-sized egg—namely, 2 oz. or over in weight. In selecting a male to head the breeding-pen an endeavour should be made to have a bird with a maximum of constitutional points, and which is the son of a hen known to be a heavy layer of good-sized eggs. It is now generally conceded that the male bird is largely responsible in transmitting qualities for high egg-production. It is therefore well to make sure that he possesses a pedigree of performance in egg-laying.

It is not possible to say how many hens should be mated to one male, as this depends entirely on the vigour of the male and the amount of range available. On a free range good fertility of eggs may be obtained with one male to twenty or thirty hens, but the number of hens must be considerably reduced when the birds are under confined conditions. In the latter case six or eight of the heavy breeds and ten to twelve of the lighter breeds are sufficient for best results.

HOW TO FEED THE BREEDERS.

It will generally be found that better fertility of eggs and stronger chickens are produced from the feeding of grain to the breeders night and morning, mash food being eliminated from the ration. On no account should high egg-laying records be looked for in the breeding-pen. Thus meat, milk, or other forcing-foods should be fed with caution. At such a time birds cannot be over-supplied with green material, while crushed fresh sea-shell, gravel grit, and clean water should be within reach at all times. The aim should be to feed the birds well, while at the same time guarding them against storing up an excess of fat—a common cause of infertile eggs and the production of chickens that are difficult to rear. Having this in view, plenty of exercise is essential. Where a free range is not provided, exercise can be best induced by feeding the grain ration in deep litter in the house, whereby the birds are compelled to scratch for it.

The male should be examined frequently in order to ascertain if vermin are present. If these are found a good dusting with insect-powder will have the desired effect. Where it is found that he is not in a good breeding condition he should be taken out of the pen daily and given a good nourishing meal by himself. Very often a male is too attentive to the hens and allows them to get the bulk of the food, resulting in a rapid loss of condition in himself. An extra meal, as suggested, will do much to correct matters in this respect.

PERIOD FOR HATCHING.

For the main flock it will generally be found that from the middle of July to the end of August is the best time to have chickens of the heavier breeds hatched out, and for the lighter breeds from the middle of August to the end of September. It should be always remembered that it pays best to have the chickens hatched on the early side rather than on the late side. Besides

being more difficult to rear, the late-hatched chickens seldom grow to a desired size, and as a rule lay smaller eggs, and are always more susceptible to disease than birds hatched during the early season. The aim should be to have the chicks hatching out as the days commence to lengthen, so that they will be well developed before the hot trying summer weather sets in.

Of course, where early autumn eggs are desired the pullets must be chiefly depended upon to produce these, as at that time of the year the majority of the adult stock are commencing to take a rest prior to moulting. In such a case there is no objection to, but rather an advantage in, hatching out chickens of any breed, even White Leghorns, for the production of the high-priced autumn egg. Such stock will probably moult before the winter season sets in. The fact, however, of their producing a good supply of eggs when dear (at which time on the average plant there is much going out and little coming in) goes to show that there is more money to be made out of the early July-hatched pullets than the average poultry-keeper is aware of. Indeed, no plant can show a maximum of profit unless a good proportion of autumn and winter eggs is produced.

—F. C. Brown, Chief Poultry Instructor.

THE APIARY.

WINTER PRECAUTIONS.

BEFORE the cold weather sets in every hive should be examined in order to make sure that the frames are completely covered with sufficient dry well-fitting mats to keep the bees protected. Wherever a damp or mouldy mat is discovered it should be replaced with a dry one, and the roof examined and repaired. No draughts should be allowed around the frames. Mats made of corn-sacks cut to the exact size of a zinc queen-excluder answer all requirements of warmth. Be sure they are placed in their exact position. If placed crookedly the edges are apt to be pushed out between the hive-body and the roof, and will in time absorb enough moisture to make them damp and unwholesome.

Once more the time approaches when the necessity for shelter should impress itself on the beekeeper. It is most essential that the bees be protected from cold winds during the winter. Should no permanent shelter be available, something temporary should be erected—if the bees are expected to prove in normal condition in the spring. Manuka scrub is excellent for making a temporary wind-break.

Weeds and grass should be kept down. A good clearing round the hives in autumn will suffice until spring, and will add materially to the comfort of the bees and the well-being of the hives. Not only should the entrances be cleared, but the ground all round the hives similarly treated, and the weeds raked up and destroyed.

CARE OF HIVES.

At no other season is the welfare of the hives of such importance as during the next few months. Every hive should be raised from

the ground to the height of one brick, and if the situation is damp or low-lying it is a good plan to raise the hives still more. This will tend to keep them free from slaters (wood-lice) and other insects, and will afford less harbour for mice, as well as ensuring that the hives have a free current of air beneath the bottom-boards and are thus more likely to keep dry. Never rest the bottom-boards on the ground, or they will rot in a very short time and become mouldy and evil-smelling.

Before bad weather sets in it is a good plan to give a coat of paint wherever it is needed, at the same time stopping up all cracks in the supers. Cracks afford ventilation during the summer months, but they are hardly to be advocated on that account, because the beekeeper will usually find that towards the end of the honey-flow the bees will use much valuable time in gathering propolis to paste up the cracks in view of the approach of winter. The hives should be slightly canted forward, so that any rain which falls on them will drain off the alighting-board.

Apart from disease, there is no worse feature in an apiary than the presence of leaky hive-covers. A roof which allows moisture to trickle through is a constant menace to the colony it appears to shelter. Not only will the mats immediately beneath it become sodden and mouldy, but the cluster of bees in the hive stands in danger of extermination when frost sets in. There will then be pollution unspeakable on the bottom-board, where the intruding moisture mixing with dead bees and waste pollen forms a rotten fermenting mass, with a stench which the order-loving bees must find more abnoxious than does their owner. There is no excuse for leaky covers. In the autumn the apiarist should examine them for any doubtful spots, and should either cover them with zinc, ruberoid, or some other waterproof material. If economy must be practised he may cover with cheesecloth, applying to the roof first a coat of paint, then the cheesecloth, and then another coat of paint. This makes an effective waterproofing, and one which anybody can apply.

PLANS FOR NEXT SEASON.

During the off season is the best time to make plans for the following season. The beekeeper should decide what increase he desires to make, and should prepare accordingly. Making up hives and frames is exasperating work if left till the bees are crying out for room, and it should be finished long before the actual time for increasing one's stock arrives. The beekeeper should also face the question of providing himself with stocks of foundation, and make arrangements for the treatment of his surplus wax by some neighbouring maker of foundation. He should also decide on which market to place his crop, and lay his plans accordingly. It is advisable, too, that he consider the theoretical side of his occupation, and, while the bees are in a dormant condition, study the best methods of improving his stocks. Neither weather conditions, locality, nor any other factor will influence the honey crop so much as strong colonies of bees, and the apiarist should endeavour, while he has the time, to ensure that these shall be in existence during the coming summer.

PROFITABLE HONEY PLANTS.

A new book entitled "Profitable Honey Plants of Australasia," by Tarlton Rayment, has been published by Messrs. Whitcombe and Tombs. This volume is very welcome, providing a useful guide to the many valuable nectar-secreting exotic and indigenous plants and weeds of Australia and New Zealand. The author is well known as a writer on apicultural matters, and his previous book, "Money in Bees," gave him a leading place among the authorities on the subject in Australia. The opening chapters of "Profitable Honey Plants," dealing with flower-structure, especially as they relate to the secretion of nectar, at once impress the reader with the fact that Mr. Rayment has closely studied the subject with particular reference to the bee as an economic factor in the fertilization of flowers. While the author does not profess to give a complete list of the honey plants of New Zealand, those that are mentioned — placed as they are in alphabetical order and designated by their common names — should prove a valuable source of reference to our beekeepers.

THE ANNUAL CONFERENCE.

A reminder may be given that the National Beekeepers' Association meets in conference at Greymouth on the 3rd, 4th, and 5th June. It is expected that beekeepers from all parts of the Dominion will attend. Lectures and demonstrations by leading commercial beekeepers will be given. Apart from the business of the conference, the officers of the local branch are arranging an excursion to view some of the scenic features of Westland.

—E. A. Earp, Senior Apiary Instructor.

HORTICULTURE.

SOIL-TREATMENT.

THE effects on the land of continuous cropping of one kind was well known to our forefathers. The bad results were overcome by laying the land down in grass and clover for a period, and thus allowing it to recuperate. In more intensive methods of culture the difficulty was avoided by a suitable rotation of crops. Potatoes subject to early and late blight would be followed by an entirely different crop — possibly peas—which was not at all subject to the same diseases, and would then die out for want of a host, the heavy demand on plant-nutriment in the soil being made up by generous applications of manures. Much of the land in this country—too much, possibly—devoted to horticultural crops is very high-priced owing to its situation within town boundaries — circumstances which compel the grower to confine his attention to those crops only that give a maximum return. A position which is more acute still is where the crop is grown in land under glass. Scientists have devoted a great deal of time during recent years to meet the position, and our correspondence shows a keen demand for this class of information.

In the application of steam to the soil, under right conditions, we have a wonderfully effective remedy, the only objection to which is its cost, although where there are a sufficient number of growers of crops

under glass in a locality they might well co-operate in securing an outfit for mutual use. Small quantities of soil may be sterilized by baking it in a pan in an oven before sowing the seed, or placing the box over a sink and pouring a gallon or two of boiling water into it as fast as the soil will take it up, afterwards standing it aside till sufficiently dry for sowing.

With chemicals we have much less certain agents, although good work has been done. While many chemicals when applied to the soil act to a certain extent both as a fungicide and an insecticide, it is well to clearly ascertain the character of the primary trouble to be dealt with before selecting a chemical remedy. For instance, eelworm, insect larvæ, and fungus in the soil require distinctive treatment.

Where eelworm is the main trouble, experience has shown carbon bisulphide to be the best chemical remedy. Use it at the rate of 6 oz. per square yard, pouring it into a number of holes about 5 in. deep; then fill and tamp the holes. Afterwards water the ground if the surface is loose or dry. A good method of doing this is to mark off the land in lines 1 ft. apart, cross-mark them by the same distance, and make the holes at the intersections, pouring in two-thirds of a fluid ounce of the chemical, an assistant following filling in and tamping the holes. For a glasshouse 100 ft. by 25 ft. 10½ gallons of carbon bisulphide would be required. A useful non-poisonous fungicide for this purpose is a 1–100 solution of formalin (formaldehyde), applying about 1 gallon of mixture per square foot. Two or three weeks should elapse before sowing or planting the land so treated.

Growers who are not suited by these methods might try the "Cheshunt Compound." It contains 2 oz. copper sulphate (bluestone) and 11 oz. ammonium carbonate reduced to a fine powder and thoroughly mixed. Store it in a dry state in a tightly corked glass or stone jar for at least twenty-four hours before using. A solution is prepared by dissolving 1 oz. in a little hot water, and making up to 2 gallons with water. Water the infected soil, after which immediate planting may follow. Infected soil may be treated after seeds or plants are in position. This is specially recommended for fungi causing "damping-off" and root troubles.

As tomato-growers will now be commencing another season, the foregoing information will be useful to many. During the season just past "damping-off," black-stripe, fusarium wilt, and sclerotinia were very troublesome in places. Fruit affected with the latter disease was very noticeable. It is quite true that "prevention is better than cure," and the best treatment is good drainage and cultivation, and a carefully considered use of manures. Many growers engaged in intensive culture on heavy land might well use more lime, especially for the tomato crop.

VEGETABLES AND POTATOES.

Broad beans may be sown now, and in suitable localities sow peas and plant out lettuce. For early planting seed potatoes should be secured now, spread in trays for sprouting, and stored in a light airy place. Should the potato-moth be about, dip them in a mixture composed of 1½ lb. arsenate of lead and 50 gallons water. Where new land in grass has to be broken in, a commencement should now

be made by skim ploughing and allowing it to lie until the turf is killed. Where available, manure from the cow-sheds and stables should be carted out, and a liberal dressing applied to land that is to be planted out in early potatoes and main-crop cabbage and cauliflower. Plough it in, and commence that thorough preparation which is so necessary.

THE SMALL-FRUIT SECTION.

The pruning of the small-fruit section will now demand attention. Black currants should be pruned to induce an abundance of strong young wood in the bushes; this may be done by cutting back old wood to a bud near the base. Red and white currants require an almost opposite treatment. It is best not to top the main growth in these bushes after the first year or two; maintain an open centre and remove all suckers.

To allow gooseberries to become crowded is fatal to best results. Prune to keep the growth well spread out, and renew the laterals by shortening to base buds those that are old or weak. The carrying-out of these simple directions would bring about great improvement in many plantations of these useful berries.

Raspberry-canes are usually cut out as soon as they have fruited; if this has not been carried out it should be done now, taking care to cut low down, removing also canes that are out of place, and cutting down those that are weak. Owing to the prevalence of cane-wilt and anthracnose, carefully carry out the old canes and burn them.

Much the same treatment is suitable for the loganberry, which is now so popular, with the further addition of training in the new running canes. These are usually divided into four bundles, two being wrapped round and left on a lower wire and secured, and the other two in a similar manner on the upper wire of the trellis.

—W. C. Hyde, Horticulturist.

New Rabbit Districts.—The constituting of the following rabbit districts, for the purposes of Part III of the Rabbit Nuisance Act, has been gazetted: Mairoa, Arapae, and Oparure (all in Waitomo County), and Akitio (in the county of that name).

Honey-export Control.—For the purpose of enabling the New Zealand Honey Control Board effectively to exercise a limited control over export, shipment of honey to Europe has been prohibited save by license from the Minister of Agriculture, subject to such conditions as may be approved by the Board.

Wheat and Oats Threshings.—Returns of actual threshings up to 20th April received by the Government Statistician from threshing-mill owners showed that until then 2,810,292 bushels of wheat and 2,991,913 bushels of oats had been threshed out. The average yields per acre in cases where particulars of areas were furnished (covering 99 per cent. of total threshings) worked out at 34·05 bushels for wheat and 39·73 bushels for oats. The figures for the Canterbury, Otago, and Southland Land Districts respectively were as follows: Canterbury—Wheat, 2,283,580 bushels threshed, averaging 34·66 bushels per acre; oats, 1,636,211 bushels threshed, averaging 38·84 bushels per acre. Otago—Wheat, 427,192 bushels, averaging 31·89 bushels per acre; oats, 691,796 bushels, averaging 40·11 bushels per acre. Southland—Wheat, 42,602 bushels, averaging 32·89 bushels per acre; oats, 515,403 bushels, averaging 43·77 bushels per acre.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

TROUBLE WITH DRAUGHT MARE.

"SUBSCRIBER," Ashburton :—

I would be obliged for advice in connection with a mare about eight years of age. She takes bad turns when in work, at irregular times. As soon as unyoked she stands, sweats all over, and blood-tinged froth runs from both nostrils. These turns pass off in a few hours and she then appears to be quite normal. She is in good condition.

The Live-stock Division :—

This case appears to be an unusual one, and a definite opinion would necessitate a personal examination. From the symptoms described the trouble may be due to a hyperæmia (congestion) of the lungs resulting from overheating by hard or fast work. Injuries to the mucous membrane of the air-passages, or tumours occurring therein, might produce symptoms similar to those described; and bleeding from the nostrils is sometimes a symptom of heart-disease. It is presumed that the collar has been examined, as an ill-fitting one may be a contributory cause; also that care has been taken not to feed with dusty or mouldy fodder, which tends to irritate the mucous membrane. In the circumstances you are advised to consult a qualified veterinary surgeon.

MAKING BASIC SUPER.

L. J. W., Whatoro :—

Please advise me as to the ingredients required and quantity of each for making a ton of basic super.

The Chemist :—

Basic super may be easily prepared by intimately mixing ordinary superphosphate with slaked lime. Fifteen per cent. of lime is sufficient to revert the water-soluble phosphate, therefore 17 cwt. of superphosphate should be mixed with 2½ to 3 cwt. of slaked lime of good quality.

GLASSY CORE IN APPLES.

W. MCMULLEIN, Waimamaku :—

Would you kindly inform me what causes apples to have a glassy, watery-looking core? I have some young trees which have been bearing about two years; one variety in particular, an Irish Peach, has been affected both seasons. This tree is a vigorous grower and well looked after.

The Horticulture Division :—

The condition of glassy core in apples is due to excessive water in the affected tissues, and usually is troublesome only in small crops on young trees in particularly vigorous condition. Such fruit stored in a somewhat dry atmosphere for a short time often recovers from the trouble.

SHORT WIND AND FROTHING IN HORSE.

"AGRICOLA," Hinds :—

I have a draught mare which is a good worker but has always been very short-winded (though not a loud roarer), and froths at the mouth a good deal while at work. Even the bottom of the manger is often almost covered with froth which comes from her while she is licking rock salt. She has always been well fed and never overworked by me. Could you kindly give me your opinion and a treatment?

The Live-stock Division :—

The description given is insufficient for forming a definite opinion, but we are inclined to think the short-winded condition is due to the mare being broken-winded, while the frothing at the mouth is probably the result of irregular or sharp teeth. There is no cure for broken wind, but proper dieting helps to alleviate the trouble. We should advise having the mare's mouth examined and attention given to her teeth.

EGGS AND EGG-PULP IN COLD STORAGE.

A RETURN issued by the Government Statistician shows the following stocks in the Dominion as at 31st March, 1925—corresponding figures for the same date in 1924 being added in parentheses : Eggs in shell, 59,698 dozen (44,942 dozen) ; egg-pulp, 584,601 lb. (840,889 lb.) ; frozen whites, 1,773 lb. (2,618 lb.) ; frozen yolks, nil (nil).

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 12th March to 23rd April, 1925, include the following of agricultural interest :—

No. 53287 : Milking-machine teat-cup support ; E. Sattler, Hurleyville. No. 53293 : Wire-strainer ; Donald and Sons, Ltd., Masterton. No. 50814 : Axe-handle guard ; W. Wilkey, Riversdale. No. 51979 : Insect-destroying ; American Cyanamid Co., New York. No. 52970 : Chaffcutter-feed ; W. Bishop, Ballarat, Victoria. No. 51717 : Sheep-dipping bath ; B. F. Mitchell, Auckland. No. 51725 : Milking-machine releaser ; D. M. Wallace, Ltd., Te Aroha. No. 51917 : Flax-fibre bleaching ; P. M. Thompson, Green Island. No. 53536 : Milking-machine milk-measuring and sample-obtaining device ; H. Bodley, Wellington. No. 51525 : Shearing-machine hand-piece ; H. V. Rutherfurd, Ashhurst. No. 51676 : Identifying cows with their milk tests ; M. C. Drabble, Pongakawa. No. 52922 : Cream or milk aerating ; T. Topliss, Greymouth. No. 53636 : Disk plough ; G. F. Shave, Lyndhurst South, Victoria. No. 53967 : Flax-treatment ; L. C. Chaytor, Spring Creek.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington. Price, 1s.

FRUIT-EXPORT CONTROL.

THE following regulations under the Fruit Control Act were gazetted on 23rd April :—

(1.) The maximum fees payable to members of the New Zealand Fruit-export Control Board, constituted under Part I of the said Act, shall be as follows : Chairman, £50 per annum ; other members, £25 per annum. Provided that when the Chairman or any other member is engaged on the business of the Board in the Dominion, other than that connected with ordinary Board meetings, the following additional fees shall be payable : Chairman, £2 2s. per diem ; other members, £1 1s. per diem.

(2.) The maximum rate of travelling-allowance payable to members of the said Board shall be £1 per diem, plus actual locomotion expenses.

(3.) The charge payable by way of levy on all fruit produced in a district in which Part I of the said Act is for the time being in operation and intended for export shall be as under :—

Capacity of Case.	Levy per Case.
Half-bushel and under	o½d.
Exceeding half-bushel but not greater than one bushel ..	1d.

(4.) Any moneys payable under clause 3 hereof shall be paid to the Board immediately upon the shipment of the fruit from the Dominion.

An Order in Council, issued in the same *Gazette*, fixed 23rd April as the date on which the above-mentioned levy or other similar charges prescribed from time to time by regulation should become payable.

WEATHER RECORDS: APRIL, 1925.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE weather during April was, on the whole, fine, dry, and sunny, with rainfall generally below the average. In parts of Canterbury, however, the total falls were very much higher—for example, the 6·25 in. recorded at Christchurch is over three times the mean for the month. This result was owing chiefly to the passage between the 15th and 19th and the subsequent extension of a cyclonic storm off the east coast. The same remarkable tendency to intensify, after passing over the country, was evidenced about ten days earlier, so that in a brief period Canterbury experienced an unusual succession of stormy southerly weather. The east coast of the North Island mostly escaped, and the total month's fall at Napier was only 0·18 in. for three days, with bright sunshine amounting to 229 hours, and no sunless days.

—*D. C. Bates, Director.*

RAINFALL FOR APRIL, 1925, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall	Average April Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	1·96	11	0·54	3·55
Russell	3·46	12	1·63	3·39
Whangarei	2·21	15	0·53	4·95
Auckland	1·28	13	0·27	3·34
Hamilton	1·04	12	0·22	3·64
Kawhia	1·90	11	0·38	4·75
New Plymouth	1·83	11	0·90	4·57
Riversdale, Inglewood	3·45	13	0·72	8·39
Whangamomona	3·76	11	0·84	6·68
Tairua, Thames	2·04	11	0·48	5·88
Tauranga	1·68	15	0·80	4·47
Maraehako Station, Opotiki	2·16	11	0·42	5·22
Gisborne	1·01	9	0·39	4·26
Taupo	1·12	6	0·68	3·95
Napier	0·18	3	0·13	2·17
Maraekakaho Station, Hastings	0·21	5	0·13	3·14
Taihape	0·93	10	0·32	3·37
Masterton	1·60	9	0·54	3·18
Patea	1·48	11	0·47	3·95
Wanganui	0·60	3	0·45	3·59
Foxton	2·02	9	0·50	2·57
Wellington	2·62	10	0·83	3·86
South Island.				
Westport	4·27	16	1·10	6·50
Greymouth	5·28	13	0·98	8·83
Hokitika	7·72	14	2·92	9·31
Arthur's Pass	11·21	6	3·87	17·64
Okuru, Westland	16·08	11	2·50	13·67
Collingwood	..	..	..	8·07
Nelson	1·90	7	0·74	2·93
Spring Creek, Blenheim	0·78	7	0·40	1·91
Tophouse	3·00	8	1·45	4·03
Hanmer Springs	2·68	7	1·55	3·27
Highfield, Waiau	2·61	6	1·91	2·85
Gore Bay	2·70	7	0·65	2·02
Christchurch	6·25	9	4·71	1·91
Timaru	2·10	7	0·94	1·49
Lambrook Station, Fairlie	..	..	..	2·00

RAINFALL FOR APRIL, 1925—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average April Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Benmore Station, Omarama ..	0·89	8	0·62	2·52
Oamaru	1·66	6	0·54	1·76
Queenstown	2·23	9	0·85	2·92
Clyde	1·18	8	0·18	1·34
Dunedin	2·44	16	0·66	2·72
Gore	3·35	14	0·67	3·26
Invercargill	4·72	20	0·90	4·43

PLANTS, BULBS, ETC., FOR CANADA.

THE following memorandum was issued by the Destructive Insect and Pest Act Advisory Board of Canada, dated Ottawa, 21st February, 1925:—

"It has been brought to our attention by both the Customs and Post Office Departments that shippers of nursery stock from countries other than the United States are not complying with the regulations dealing with the forwarding of parcel-post shipments. Section X of Regulation 1 (Foreign) distinctly states that all such shipments must have an official label, furnished by this Board, attached to the package. No other label should appear thereon, but the shipper is advised to place a label *inside* the package giving the name and address of the ultimate consignee. Packages with two labels are frequently forwarded direct to destination, and then have to be returned to either Montreal or Vancouver for inspection, in which case the importer is required to pay the cost of postage both ways."

It will be seen that it is necessary for senders of such material by parcel-post to communicate with and obtain the necessary label or labels from the above-mentioned Board before making the despatch.

IMPORTATION OF FERTILIZERS: MARCH QUARTER.

FOLLOWING are the importations of fertilizers into New Zealand for the quarter ended 31st March, 1925: *Sulphate of Ammonia:* United Kingdom, 50 tons; Australia, 60 tons. *Gypsum:* Australia, 45 tons. *Nitrate of Soda:* Chile, 40 tons. *Basic Slag:* United Kingdom, 5,245 tons; Belgium, 9,194 tons; Germany, 250 tons. *Bonedust:* Australia, 230 tons; India, 630 tons. *Chardust:* Australia, 45 tons. *Guano and Rock Phosphate:* Nauru Island, 27,851 tons; Ocean Island, 5,629 tons. *Phosphates, other:* Egypt, 2,468 tons. *Kainit:* United Kingdom, 356 tons; France, 128 tons; Germany, 1,160 tons; Belgium, 45 tons. *Sulphate of Potash:* United Kingdom, 136 tons; France, 30 tons; Germany, 327 tons. *Muriate of Potash:* Belgium, 1 ton. *Potash, other:* United Kingdom, 230 tons; France, 70 tons; Germany, 370 tons. *Sulphate of Iron:* Australia, 28 tons. *Other Manures:* United Kingdom, 1 ton; Australia, 1 ton; Canada, 1 ton.

TOP-DRESSING OF PASTURE FOR IRON-HUNGER.

IN connection with the suggestions for curative top-dressing made in the *Journal* for March, p. 186, it is advisable to emphasize that if basic slag and sulphate of iron are mixed, the mixture should be made up in small quantities as required for immediate application; or if left standing for any time it should be spread in a thin layer on the mixing-floor. This mixture if left in bulk or in bags is liable to develop considerable heat, with the formation of a hard mass that can be broken up again only with great difficulty.—*Chemistry Section.*

GRASS- AND CLOVER-SEEDS HARVEST, SEASON 1924-25.

THE following brief survey of this season's harvest in New Zealand of the principal grass and clover seeds grown is supplied by Mr. N. R. Foy, the Department's Seed Analyst :—

Rye-grasses.—Perennial : A good crop of heavy-weight seed was harvested in Southland ; in Canterbury the crop was poor; in the Sandon district the yield was good and the seed nice in appearance, but the germination poor; Hawke's Bay and Poverty Bay had an average yield of good-quality seed. Western Wolths and Italian : Good crops of excellent-quality seed.

Cocksfoot.—Akaroa : Short crop of very light seed. Plains : Good average yield of fair-quality seed.

Crested Dogstail.—Small crop of good-quality seed.

Danthonia.—Yield good, and seed particularly good, especially that from Canterbury.

Chewings Fescue.—Fairly short crop of average quality.

Brown-top.—Good crop of nice-quality seed in the North. Apparently very little was harvested in Southland.

Cow-grass.—Medium yield of average quality in Marlborough. In Canterbury the crop was poor generally, although the seed is of good quality.

White Clover.—Medium yield in Marlborough, and a poor harvest in Canterbury. Supplies will probably be a little short this year.

POULTRY IMPORTATION AND FOWL-PEST.

AN Order in Council gazetted on 7th May prohibits, save under permit issued by the Minister of Agriculture, the importation into New Zealand of poultry (including domestic fowls, ducks, geese, and turkeys) from any country other than the Commonwealth of Australia, unless each lot is accompanied by an official certificate from the country of export that fowl-pest (*Pestis gallinarum*) has not been known to occur in that country during a period of two years preceding date of certificate.

Fowl-pest is an acutely infectious disease caused by an ultra-microscopical virus, and in its course resembles chicken-cholera. It is usually fatal, no effective treatment being known. The disease was first reported from northern Italy, afterwards from Tyrol, Germany, Belgium, and France, and later from England. It has recently spread to the United States, and drastic measures have been put into force to suppress it. Canada has already issued regulations aimed at excluding the disease from her territory. It will therefore be recognized that restrictions on importation to this country are essential for the safety of our poultry industry.

FORTHCOMING WINTER SHOWS.

Otago A. and P. Society : Dunedin, 2nd to 6th June.
Waikato Winter Show Association : Hamilton, 2nd to 6th June.
Manawatu A. and P. Association : Palmerston North, 16th to 20th June.
Wanganui A. and P. Association : Wanganui, 24th to 27th June.
Poverty Bay A. and P. Association : Gisborne, 25th to 27th June.
Wellington Winter Show Association : Wellington, 30th July to 15th August.
Auckland Winter Exhibition : Auckland, 15th to 22nd August.

Ruakura Pedigree Stock Sale.—At this year's annual sale, held on 8th April, Milking Shorthorn cattle sold fairly well, but there appeared to be very little demand for Jersey bulls. The demand for Berkshire pigs was very keen. Following are average prices obtained for the stock sold : Shorthorn bulls, £34 ; Shorthorn heifers, £24 ; Jersey bull, £21 ; Berkshire boars, £8 5s. ; Berkshire sows, £7 5s.